Technical Report 1140

Training Effectiveness Evaluation Of The Full Spectrum Command Game

Scott A. Beal and Richard E. Christ
U.S. Army Research Institute

January 2004

United States Army Research Institute for the Behavioral and Social Sciences

U.S. Army Research Institute
for the Behavioral and Social Sciences

A Directorate of the U.S. Army Human Resources Command

ZITA M. SIMUTIS
Director

Technical Review by

Kenneth L. Evans, ARI
Margaret Salter, ARI
James Belanich, ARI

NOTICES

REPORT DOCUMENTATION PAGE

1. REPORT DATE (dd-mm-yy)	2. REPORT TYPE	3. DATES COVERED (from. . . to)
January 2004	Final	June 2002 to October 2003

4. TITLE AND SUBTITLE

Training Effectiveness Evaluation of the Full Spectrum Command Game

5a. CONTRACT OR GRANT NUMBER

5b. PROGRAM ELEMENT NUMBER
62785

6. AUTHOR(S)

Scott A. Beal and Richard E. Christ (U.S. Army Research Institute)

5c. PROJECT NUMBER
A790

5d. TASK NUMBER

5e. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)

U.S. Army Research Institute for the Behavioral and Social Sciences
Infantry Forces Research Unit
P.O. Box 52086
Fort Benning, GA 31995-2086

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

U.S. Army Research Institute for the Behavioral and Social Sciences
5001 Eisenhower Avenue
Alexandria, VA 22304-4841

10. MONITOR ACRONYM
ARI

11. MONITOR REPORT NUMBER
Technical Report 1140

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

Authors are listed in alphabetical order, as they contributed equally to this research.

14. ABSTRACT *(Maximum 200 words)*:

Fifty-four officers in the Infantry Captains Career Course at Fort Benning, Georgia, participated in a training effectiveness evaluation of a video game named Full Spectrum Command (FSC). Half were assigned to play FSC and participate in normal course work for commanding a light Infantry company in urban offensive operations; the other half did only the normal course work. Pre-FSC measures were for military experience, general cognitive ability, and decision-making style. A questionnaire administered to officers who played FSC documented their sense of personal involvement in the FSC environment, their perception of the training value of the game, and their opinions of FSC strengths and weaknesses. Officers in both groups were assessed individually for the adaptiveness of their decision-making behavior as the commander of a light Infantry company during a tactical exercise using the Janus simulation. Shortcomings in experimental procedures confounded between-groups comparisons for adaptive decision-making behaviors, but other results suggest FSC can provide tactical experiences with potential training value. Prior military experience was related to personal involvement with FSC, perceived training value of FSC, adaptive decision-making behavior in Janus, and decision-making style. Officers who played FSC identified its strengths and changes desired in future versions of the game.

15. SUBJECT TERMS

Video Games Training Decision Making Measurement Human Performance Cognitive Flexibility Infantry Company Combat Simulation Military Operations in Urban Terrain (MOUT)

SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT	20. NUMBER OF PAGES	21. RESPONSIBLE PERSON (Name and Telephone Number)
16. REPORT	17. ABSTRACT	18. THIS PAGE			
Unclassified	Unclassified	Unclassified	Unlimited	65	Scott A. Beal (706) 545-2356

Technical Report 1140

Training Effectiveness Evaluation Of The Full Spectrum Command Game

SCOTT A. BEAL AND RICHARD E. CHRIST
U.S. ARMY RESEARCH INSTITUTE

Infantry Forces Research Unit
Scott E. Graham, Chief

U.S. Army Research Institute for the Behavioral and Social Sciences
5001 Eisenhower Avenue, Alexandria, VA 22304-4841

January 2004

Army Project Number
20262785A790

Personnel Performance and
Training Technology

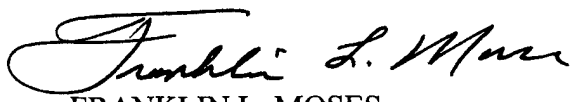
FOREWORD

The Infantry Forces Research Unit of the U.S. Army Research Institute for the Behavioral and Social Sciences conducts research under a Science and Technology Objective, *Training Objective Force Small Unit Leaders and Teams*. The aim of the research is to design efficient, effective cognitive skills training to better facilitate rapid and accurate decision making. In essence, this research leverages advances in situational awareness training and measurement, tailorable training, computer gaming, and intelligent tutoring. As part of this objective, our behavioral scientists work closely with other agencies and organizations to identify new training methods and technologies being developed and used in the private sector. We examine these methods and techniques for their usefulness in training leader cognitive skills and in developing and validating methods and measures necessary to assess leader decision making and information utilization.

Recently, we were asked to participate in the design and execution of field research to evaluate the training effectiveness of a personal computer-based video game named Full Spectrum Command (FSC). The game was developed for the Army by the Institute for Creative Technologies at the University of Southern California, with resources and expertise provided by both technology-driven talent from the entertainment software industry and military personnel from the U.S. Army Infantry School. The objectives of the game were to let prospective company commanders in the Infantry Captains Career Course conduct mission analysis and planning, experience the decision-making requirements that occur during mission execution, and enhance their ability to adapt to emerging conditions on a simulated battlefield.

Shortcomings in experimental procedures confounded the measurement of adaptive decision, making it difficult to gauge behavioral differences between officers who played FSC and those who did not. However, other results suggest that playing the game provided tactical experiences with potential training value. Officers who played FSC identified specific strengths in the game and suggested changes that should be made in future versions. Measures used to quantify the prior military experience and decision-making style of officers were shown to be related to their opinions about the training value of FSC, as well as to measures of adaptive decision-making behaviors.

Results of this research were briefed to the Director of the Combined Arms & Tactics Directorate, the Chief of the Tactics Department, and other key individuals at the U.S. Army Infantry School, as well as to individuals associated with the Center for Creative Technologies. They also were presented at meetings of the behavioral science community and at a major training games symposium. We believe our results will influence the development of future training methods and tools for assessing decision-making behaviors.



FRANKLIN L. MOSES
Acting Technical Director

ACKNOWLEDGEMENTS

The authors want to acknowledge publicly the dedicated and cooperative contributions of the small group instructors and team leaders for the Infantry Captains Career Course at Fort Benning, Georgia. They and their students worked diligently and patiently with us over many weeks during the planning and execution of this research effort, even though they were already fully committed to other duties and responsibilities. Special thanks go to Major Brent Cummings, one of the team leaders for the course, for his subject matter expertise, and his willingness to create the conditions necessary for our evaluation of the Full Spectrum Command game. Special thanks go also to James H. Centric of Northrop Grumman Mission Systems, Inc. for his indispensable assistance in the design of the Janus exercise and Janus Scenario Assessment Checklist, and for serving as the observer/controller for that exercise.

TRAINING EFFECTIVENESS EVALUATION OF THE FULL SPECTRUM COMMAND GAME

EXECUTIVE SUMMARY

Research Requirement:

The U.S. Army's transformation strategy includes new force capabilities that will assure dominance across the full spectrum of military operations. These capabilities will also require that combat leaders make rapid adaptive decisions in response to changing information about battlefield conditions. This requirement has increased demands for new training methods to develop the cognitive skills required by future leaders. Recent popular news accounts have begun to emphasize the potential value of video games for training cognitive skills and decision-making behaviors. This report documents the approach and results of research to evaluate the training effectiveness of one such video game named Full Spectrum Command (FSC).

Procedure:

Fifty-four officers enrolled in the Infantry Captains Career Course at Fort Benning, Georgia, served as participants in this research. One-half were assigned to a group that played FSC in addition to participating in the regularly scheduled course work for commanding a light Infantry company during urban offensive operations. The others received only the course work. Pre-FSC measures were obtained of the officers' experience in military service, general cognitive ability, and decision-making style. The conduct of the class and the behavior of officers in the FSC group were recorded during their train-up and during their subsequent playing of FSC. A questionnaire administered to officers in the FSC group documented their sense of personal involvement in the simulated mission, perceptions of FSC training value, and opinions of the strengths and weaknesses of the game. Following the period for playing FSC, officers in both groups were re-administered the decision-making style inventory and assessed individually for their tactical decision-making behaviors as the commander of a light Infantry company in a tactical exercise using the Janus simulation. A Janus Scenario Assessment Checklist was used to estimate each officer's ability to adapt to changing and uncertain battlefield conditions during the Janus exercise.

Findings:

Several shortcomings in experimental procedures used for playing FSC confounded comparisons of adaptive decision-making behaviors between officers who played FSC and those who did not. However, other results suggest that playing FSC provided tactical experiences that had potential training value. Officers who played FSC identified specific strengths in the game as well as changes that should be made in future versions. Measures used to quantify the prior military experience of officers were related to their perceptions of personal involvement in and training value of FSC, their adaptive decision-making behaviors in Janus, and their decision-making style.

Utilization of Findings:

The results of this research will influence the future development of training games and tools for assessing decision-making behaviors. Findings were discussed with key individuals from the Army training community at Fort Benning, as well as the commercial training technologies industry. Descriptions of the research have also been presented at meetings of the behavioral science community and at a symposium devoted to the training value of games.

TRAINING EFFECTIVENESS EVALUATION OF THE FULL SPECTRUM COMMAND GAME

CONTENTS

CONTENTS (continued)

Page

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Background

The U.S. Army's transformation strategy includes new force capabilities that will assure dominance across the full spectrum of military operations. However, experience has shown that the best capabilities cannot support command and control of the force without trained personnel. With information available to all levels of the command and increasing dispersion on the battlefield, junior leaders may find themselves operating almost autonomously (Department of the Army, DA; 2003). In the absence of detailed orders to cover possible battlefield contingencies, these leaders need to be trained to accept risk, seize the initiative to counter unforeseen enemy actions, and modify plans quickly when conditions change. Required training must increase the adaptability or flexibility of the leader's decision-making performance.

Typically, Army training utilizes the crawl-walk-run approach (DA, 2002). This method begins at the basic level in which training events are relatively simple and resource requirements are minimal. However, training at this level can sometimes lack realism. As the difficulty and complexity of training events increase, there is a requirement for more resources, but the level of realism can increase to simulate conditions expected in a combat environment. Those responsible for training small unit leaders rely upon a mix of techniques to accomplish their training objectives. Interest in using relatively low-cost simulators to emulate realistic combat environments has increased along with the sophistication and power of personal computers. This report addresses one effort to use a personal computer-based combat simulation to help train future company commanders in the Army.

The effort was part of a developmental tasking by the U.S. Army Program Executive Office – Simulations, Training & Instrumentation (PEO-STRI) to the Institute for Creative Technologies (ICT) at the University of Southern California. This tasking focused on creating computer "games" to be used as learning tools for the cognitive development of small unit leaders. To accomplish this task, the ICT went to the entertainment software industry for resources and expertise. One of the resulting products was a personal computer-based game dubbed Full Spectrum Command (FSC). This game was designed for use in the Infantry Captains Career Course (ICCC) at Fort Benning, Georgia. It let students in the course, ***prospective*** company commanders, conduct mission analysis and planning, and it then enabled them to experience the decision-making requirements that occur during mission execution.[1] A specific additional purpose of the simulation was to sharpen the students' ability to adapt to emerging threats and changing conditions on the simulated battlefield. The Infantry Forces Research Unit of the U.S. Army Research Institute (ARI) at Fort Benning, Georgia, was asked by PEO-STRI to conduct an empirical evaluation of FSC. The U.S. Army Research Development and Engineering Command – Simulation Technology Center (RDECOM-STC) was responsible for monitoring this effort. This research report documents the approach taken and the results of this evaluation.

---

[1] For ease of scientific discourse, the officers enrolled in the ICCC who participated in this evaluation research are called alternatively students, participants, and players. Because all the officers were males, they are referred to by using only masuline pronouns.

The FSC Game

FSC is a computer-based simulation of an urban environment in which a U.S. Army Captain commands a light Infantry company offensive operation.[2] The simulated terrain in FSC represents a 1-kilometer square area modeled roughly after the McKenna Military Operations in Urban Terrain (MOUT) Site at Fort Benning, Georgia. Blue force structures portrayed in FSC simulate those available to a typical light Infantry company commander. The enemy force represented in the game is the kind of asymmetric force that might be encountered in typical urban fighting. It consists of loosely organized small groups of men who possess AK47A rifles, rocket propelled grenades, and sniper rifles.

Early in the development of FSC, subject matter experts were drawn from the pool of small group instructors for the ICCC. These subject matter experts provided input into the development of the artificial intelligence software that determined doctrinally correct actions by blue force and enemy force elements in the simulated battlefield environment. In addition, since they recognized the potential value of a company command simulation, the subject matter experts ensured that FSC was developed and structured to meet training needs of the ICCC. However, constraints during the development of FSC did not allow the implementation of some battlefield assets such as combined arms, close air support, engineers, and mechanized forces. In spite of these limitations, the game provided small group instructors at the ICCC with another tool to train company commander skills.

FSC presents a battalion operations order to the student who is playing the game. A series of computer monitor screens facilitate the player's analysis of the assigned mission, his organization of available assets across maneuver units, and his creation of a mission execution matrix that synchronizes the performance of required tasks by the maneuver units over successive phases of the mission. Once these required planning steps have been completed, the player can initiate action and begin the experience of observing and responding to emerging conditions portrayed in the simulated battlefield. The capability of FSC to permit the player to respond to emerging battlefield conditions is a unique feature of FSC. The player can issue fragmentary orders to change his original plan if it becomes irrelevant due to emerging events. Consequently, FSC permits the player to practice the behaviors necessary to acquire and maintain adaptive decision-making skills in a realistic and dynamic tactical environment. FSC tracks and records data automatically that describe what happens during the execution of a mission. The accessibility of those data and the capability of FSC to replay specified portions of the mission provide opportunities for a player and an instructor to examine the mission in detail. This performance feedback facilitates the proper development of the player's adaptive command and control skills.

Instructional Characteristics of the ICCC

The ICCC program of instruction is quite full, leaving little room for any deviation from the prescribed schedule of instructional events. The typical class is about 18 weeks in duration. The first ten weeks are devoted to instruction and practical exercises designed to develop the

[2] A User Manual for FSC provides a detailed description of the game. An electronic copy of the User Manual, in Adobe PDF format, is available from the authors.

cognitive skills needed to command and control a company-size tactical unit. The goal of this section of the class is for the student, acting as a company commander, to issue an operations order for an Infantry company. Subsequent sections of the class are devoted to instruction and practical exercises designed to develop the student's ability to serve as a company-grade battalion or brigade staff officer (six weeks), to plan and prepare training as a company commander or as an assistant staff officer (one week), and to participate in focused experiential exercises to expand their knowledge about specific type of organization in which they will be commanding a company (one week).

Beginning around the fifth week in the class, the students begin a six to seven day lesson devoted to commanding a light Infantry company in urban offensive operations. This particular lesson stresses urban terrain analysis, the understanding of weapons effects, integration of non-organic forces, enemy defensive tactics in urban areas, and specific planning considerations for urban operations. The lesson is designed to reinforce the mission analysis, course of action development, and course of action analysis processes of the troop leading procedures. Its terminal learning objective is for the student to demonstrate an improvement of his visualization of the tactical problem and an ability to describe his plan for executing and synchronizing a light company course of action in urban operations. The standard for demonstrating these skills is the student's performance while he briefs his mission analysis and course of action. An after action review of the briefing consists of interactive discussions among the students and the small group instructor.

The ICCC has not been able to provide realistic experiences for the adaptive decision-making necessary to respond to changes that occur in the threat or other battlefield conditions. Likewise, students have not had repeated opportunities to practice and actually experience the consequences of executing their operational plans or changing their plans in response to emerging conditions on the battlefield. FSC was designed and developed, in part, to fill these gaps in student training and experience.

Evaluation Concepts and Objectives

We recognized that opportunities for students to play FSC would occur in the context of an ongoing program of instruction. This was to be an instance of field research and not controlled experimental research. During initial meetings between the authors and the leadership of the ICCC, the need was stressed for the maximum possible control over procedures for using FSC in the course and for the use of multiple methods to assess the potential impact of FSC on the command abilities of the students. As preparation for this evaluation research began, it was agreed by all interested parties that the research objectives would include the following sets of analyses:

(1) The principal measure of the training effectiveness of FSC on the acquisition of adaptive decision-making skills would be derived from measured comparisons between students assigned to a group that played FSC and those assigned to a control group that did not play FSC.

(2) A second basis for evaluating the training impact of FSC on adaptive decision making would be observations and ratings of students who played FSC by ICCC small group instructors.

The students' responses to a questionnaire designed to record their perceptions and opinions of FSC would the aid evaluation.

(3) Other data pooled over students in both the FSC and control groups, while unrelated to the impact of FSC per se, would be analyzed for their potential value to those responsible for training at the ICCC and to other Army leaders.

METHOD

Participants

Students enrolled in two different seminars for each of two successive classes of the ICCC served as participants in this evaluation research. In each class, students in one seminar were assigned to participate in the FSC group and those in the other seminar were assigned to participate in the control group. There were 14 students in each seminar during the first class and 13 in each seminar during the second class, 27 participants for each group. Other than having different small group instructors directing the activities of their seminars, the students from the four different seminars were presented the same program of instruction with one exception. Students in the FSC groups were given opportunities to play FSC over a period of about seven class days, while those in the control group had no instruction or hands-on experience with FSC.

Measurement Instruments

Biographical Information Questionnaire

A copy of the Biographical Information Questionnaire is presented on pages A-2 and A-3 of Appendix A. This questionnaire was designed by the authors to permit each student to describe the types and breadth of experiences he had that might be relevant to this evaluation research. In addition to requesting basic demographic information from each student (name, age, time in service, rank, time in rank, source of rank, and branch), the Biographical Information Questionnaire focused on seven different indicators of military experience:

- Previous duty positions, the units in which the positions were held, and the duration of the assignments;
- Types of Army training courses completed;
- Courses completed during any prior enlisted service;
- Experiences at Combat Training Centers;
- Experiences (in combat or in stability and support operations) during deployments outside the continental U.S.;
- Experiences during platoon, company, or staff assignments with each of 14 different key military events; and

- Experiences with military training simulations and commercial computer games.

Test of General Cognitive Ability

The Wonderlic Personnel Test was used to obtain a measure of the general cognitive ability of participants. The current version of this instrument is based on the result of over 60 years of testing and research by a wide variety of organizations around the world for many different job positions and for education levels from the seventh grade through post-college graduate. The test consists of 50 questions covering a wide variety of problem types. The questions are arranged in the test booklet in order of their difficulty, beginning at a modest level and increasing gradually in difficulty. Test scores are based on the number of questions answered correctly in a 12-minute test period.

Research has shown that participants with higher scores tend to learn more quickly, master more complex material, and make better judgments when information is lacking than those with lower scores. Participants with lower scores tend to require more time, specific instructions, and structured job routines than those with higher scores. The median score obtained by high school and college graduates in the U.S. is 21 and 29, respectively. Dodrill (1983) reported the long-term test-retest reliability of the test was .94. After finding a correlation of .91 between scores obtained on the Wonderlic Personnel Test and the Wechler Adult Intelligent Scale, Dodrill and Warner (1988) concluded that the Wonderlic test is valuable as a brief measure of general intelligence. Detailed information and sample questions for the Wonderlic Personnel Test can be obtained from the web site of its producer, http://www.wonderlic.com.

Decision-Making Style Inventory

We used a method developed by Nygren (2000) to assess each student's propensity to use one or more of three distinct styles or strategies for decision making. A copy of the instrument, the Decision-Making Style Inventory, was provided to the authors for use in this research. It is given on pages A-4 and A-5 of Appendix A. The Decision-Making Style Inventory consists of 45 items, 15 on each of three scales. The student indicated his level of agreement or disagreement to each item using a six-point rating scale, yielding a total score between 15 and 90 on each scale. Scores on the three scales were shown to be highly correlated with the use of an ***Analytical***, an ***Intuitive***, or a ***Regret-based Emotional*** decision-making style in two separate studies, each using over 800 college students (Nygren, 2000). The mean (and standard deviation) of scores reported from one of these studies were, respectively, 64.8 (9.8) for the Analytical scale, 61.3 (9.4) for the Intuitive scale, and 58.5 (11.6) for the Regret-based Emotional scale.

Nygren (2000) reported that scores on the three scales were essentially orthogonal, suggesting that the scales measure independent unipolar dimensions and not opposite ends of one or more unidimensional continua. Consequently, a given individual could score high (or low) on more than one scale. The construct validity of the Decision-Making Style Inventory was established by relating scores among the three scales to other well-established measures of individual thinking and decision-making strategies. In summary, these comparisons support the following conclusions:

- High analytic individuals are more likely to employ ***rational-thinking styles***, be performance- and training-goal oriented, and have a high need for cognition orientation, and are less likely to be risk seeking, impulsive, and work intolerant.
- High intuitive individuals are more likely to employ ***experiential-thinking styles***, be more goal oriented, risk seeking and impulsive, show higher self-esteem and have a greater belief in luck, and are less likely to exhibit self-deception, depression, or causal uncertainty.
- High regret-based emotional individuals tend to score higher in personal harm avoidance, workload intolerance, performance-goal orientation, self-handicapping, both personal and judgmental self-doubt, depression, and causal uncertainty, and they tend to score lower in risk seeking and self esteem.

The results of several studies (Nygren, 2000; Nygren & White, 2002; White & Nygren, 2002) have shown that a propensity toward use of either an analytic or intuitive decision-making style can affect performance on complex computer-generated tasks that simulate those performed by aircraft pilots during flight. These studies suggest a reliance on an analytical style may lead to poorer performance than relying on an intuitive approach, particularly when there are multiple subtasks, each with its own performance criteria. In addition, the studies suggest that as workload levels increased, a more intuitive style led to higher levels of performance. A regret-based emotional approach to decision making did not appear to affect performance on these tasks, leading Nygren (2000) to suggest that this decision-making strategy might be most relevant in more risky and realistic decision environments.

FSC Questionnaire

A copy of the FSC Questionnaire is given on pages A-6 to A-16 of Appendix A. This six-part questionnaire was developed by the authors to document the reactions of students in the FSC group to their experience with FSC. The FSC Questionnaire asked each student to indicate:

- The extent to which he became personally involved or immersed in his game-playing experience;
- His perceptions of the overall training value of the FSC playing experience;
- His perceptions of the training value of specific scenarios he played using FSC;
- His opinions concerning the importance and quality of the various types of FSC fidelity;
- His assessment of the extent to which the game permitted him to perform and practice action items that it was designed to permit, as well as his assessment of additional action item capabilities that should be built into future versions of FSC; and
- His written responses to a series of open-ended questions concerned with his experience with FSC and his opinion about the potential of FSC for improving the decision-making skills of ICCC students.

The specific form and substance of items included in the FSC Questionnaire were determined using inputs from and consultation with ICCC instructors at Fort Benning, the FSC developers, and contracted military subject matter experts.

It must be noted that only the 24 items in Part 1 of the questionnaire were derived from methods used in earlier research. A search of the literature did not yield any references that described methods for measuring a player's involvement or immersion in a computer-based game. However, references were found for a questionnaire that assessed reliably at least some aspects of the phenomenon called ***presence*** in research on human behavior in a computer-generated virtual simulation environment (Singer & Witmer, 1996; Witmer & Singer, 1994, 1998; Witmer, Singer and Jerome, in press). The cited researchers showed that the 32-item, Version 3.0 *Presence Questionnaire* was a reliable measure of factors that encourage involvement and enable immersion in a virtual environment. The authors selected and edited many items from that questionnaire to make them applicable to a computer-based game environment.

Janus Scenario Assessment Checklist

A detailed description of the Janus combat simulation system and procedures for its use as a training platform are found in Grotte et al. (1995). Janus is a two-sided, high resolution, interactive simulation of realistic battlefield events. The simulation is driven by a software system hosted on a mainframe computer. Janus has sufficient resolution to model individual fighting systems or individual Soldiers and can model realistically up to brigade-size forces. While originally developed to serve as an analytic tool during the design and development of materiel systems and force organizations, Janus can also be used as a training simulation and as a vehicle for assessing human performance.[3] The interactive mode of operation used during human training and assessment applications allows military commanders and staff to practice the decision-making processes required to synchronize battlefield systems over successive phases of a mission. Janus displays digitized terrain data on computer monitor screens in a format familiar to military users. It models accurately a wide assortment of friendly and enemy force elements as a function of each fighting system's capabilities, as affected by factors such as terrain, weather, and visibility. Players of Janus must consider and synchronize all aspects force employment just as they would in actual combat. If they neglect key considerations, the simulation will highlight the planning failure during the battle. Conversely, Janus will reinforce positively a fully integrated and synchronized plan.

In this research, the Janus exercise was designed to be a criterion test of the training effectiveness of FSC. It was administered to individual officers in both the FSC and control groups. The exercise was driven by a scenario developed to facilitate an assessment of each

[3] There are several constraints for using Janus routinely as a training device for individual officers. Its use requires not only a mainframe computer, but also other multiple types of physical and human resources. For example, four personnel, in addition to an ARI researcher, were required to support our use of Janus in this evaluation of FSC training effectiveness. Janus is used typically once or twice during each ICCC class to expose selected students to the experience of executing a simulated battlefield mission scenario. However, time and other resource requirements do not allow the ICCC to permit every student in a class to practice repeatedly with Janus the cognitive skills that were the focus of our evaluation.

participating student's ability to plan and direct a company-level operation. It also pushed the limits of his adaptive abilities. The scenario was based on a tactical environment in which uncertain conditions emerged. The student was required to adapt in order to complete his mission successfully. To support that scenario, a battalion operations order was developed outlining a battalion task force-level mission. In the battalion operations order, each student was tasked to plan and execute a multi-phased company-level mission. The terrain for the mission was limited to the McKenna MOUT Site and a four grid square area surrounding the site. The company mission began with a coordinated attack in sector to seize an objective, followed by the establishment of hasty defensive positions and preparation for continuing the attack.

A Janus Scenario Assessment Checklist was developed by the authors to assess each participant's ability to adapt to changing and uncertain battlefield conditions during the Janus exercise. A copy of this checklist is given on pages A-17 to A-19 of Appendix A. The checklist permitted the exercise observer/controller to evaluate each student's ability to adapt to as many as 23 mission critical tasks required to execute the mission successfully. As illustrated in Table 1, the checklist was used to indicate (a) whether the participant recognized the need to change some aspect of the operational plan due to emerging battlefield conditions, (b) whether he was prompted by the observer/controller through a series of targeted questions to recognize this need,[4] (c) the doctrinally determined appropriateness of any change made to the plan, and, if a decision was made to change a plan, (d) the outcome of implementing that decision. The assessment checklist took into account the possibility that an adaptive decision might not be required for a specific task because the task was accommodated by the initial plan or by previous activities, or because the exercise was terminated before the task was required to be performed.

Two measures were derived from the Janus Scenario Assessment Checklist to reflect the performance of students while they commanded their company in the simulated mission. In consultation with the ICCC small group instructors, the ten nominal values derived from the checklist were judged to reflect an ordinal scale of the adaptability of the student's decision-making performance for each of the 23 tasks. The highest level of adaptability was given a scale value of 1 and the the lowest level of adaptability was assigned a scale value of 10. Task performance was judged to be adaptive if it obtained a scale value of 6 or less. The percentage of tasks to which an adaptive was made was determined for each Janus player. The second measure derived from the checklist was based on whether the observer/controller provided a prompt to encourage a non-responsive participant to make an adaptive response. The percentage of tasks for which a prompt was provided was determined for each student.

In addition to assessing the performance of students with the checklist, the observer/controller identified whether a Janus player had committed any of ten common doctrinal errors during his execution of the mission (see page A-20 of Appendix A). This determination was made after the conclusion of a Janus session based on the observer/controller's review of notes he had taken on the flow of the battle that had just occurred. Consequently, a third measure of performance during the Janus exercise was the

[4] In addition to being a data collection opportunity, the Janus exercise was a learning experience for the participants. As such, instructional steps were taken by the observer/controller to insure that students' plans and actions would facilitate some level of learning and mission success.

number of doctrinal errors each Janus player committed during his command of his simulated company.

Table 1
Attributes of Adaptive Decisions Captured by the Janus Scenario Assessment Checklist

Decision Category	Recognized Need to Change?	Prompt Provided?	Implemented Good Decision?	Decision Outcome
1	Yes	No	Yes	Positive
2	No	Yes	Yes	Positive
3	Yes	No	No	Positive
4	No	Yes	No	Positive
5	Yes	No	No	Negative
6	No	Yes	No	Negative
7	No	No	Did nothing	
8	No	Yes	Did nothing	
9	Yes	No	Did not deviate from plan	
10	Yes	Yes	Did not deviate from plan	
Plan	Plan accommodated activity			
Other	No adaptive thought required because previous linking task was performed correctly			
NC	Not Completed – The task was not required because the mission was terminated before its scheduled occurrence			

Evaluation Design and Procedures

Figure 1 summarizes the timeline and procedures for data collection. During the first week of each class, pre-FSC measures were obtained of the students' status and experience in military service, their general cognitive ability, and their decision-making style. The conduct of the FSC group seminars and the behavior of students in these seminars were monitored closely and recorded for FSC train-up and play. The FSC Questionnaire was administered to all students in the FSC group following their last scheduled exposure to the game. Because FSC was experienced over successive periods by small groups of students, the FSC Questionnaire was likewise administered to small groups of students over a two-three day period. On the day

following FSC play, all students in both the FSC and control groups were re-administered the decision-making style inventory to obtain one of the post-FSC evaluation measures. Over the next nine sessions of the ICCC, Janus data were collected from students in the FSC and control groups. Descriptions of the procedures employed for conducting and collecting data during FSC and Janus sessions are presented in the next two sections of the report.

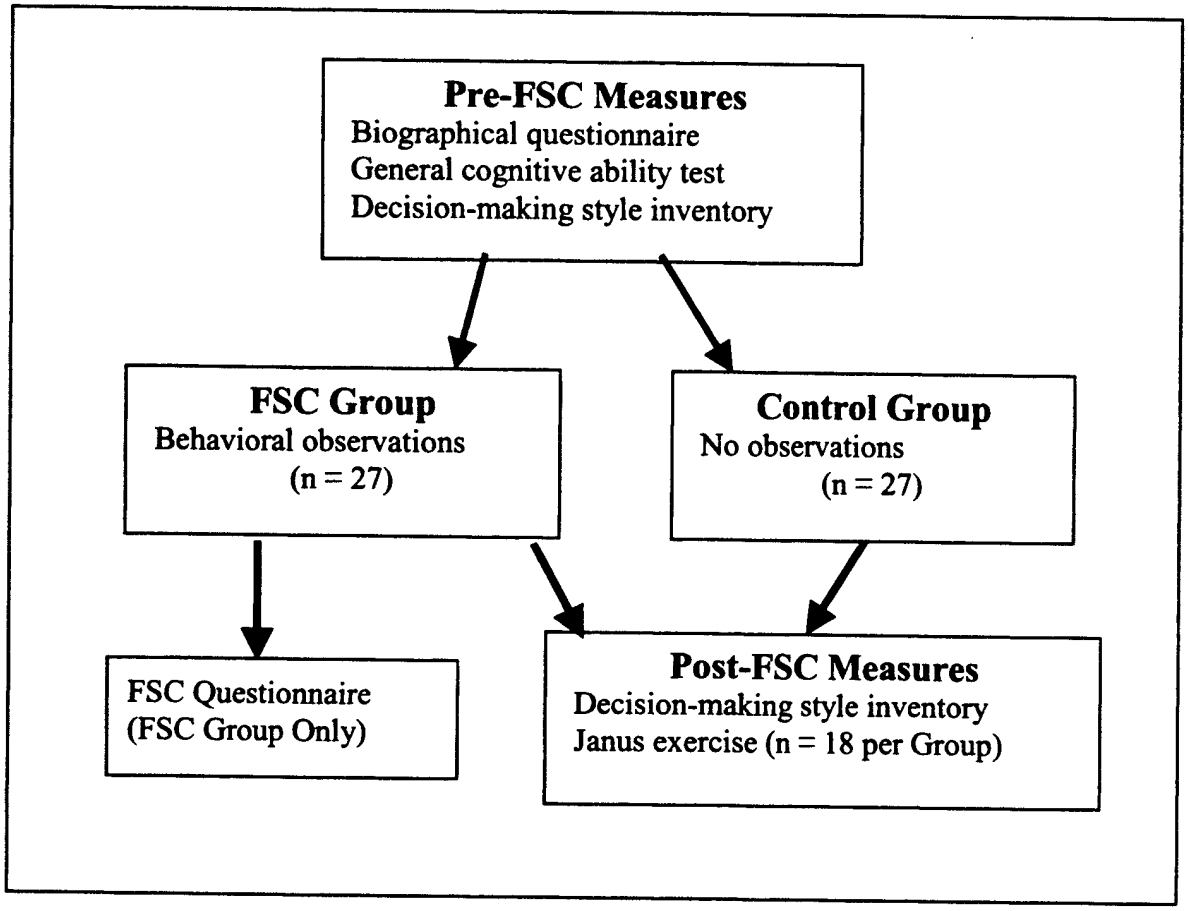


Figure 1. A summary of the timeline and procedures for the FSC evaluation.

Conduct and Observations of FSC Play

FSC was programmed to permit game play in any one of three different scenarios: reconnaissance, breach, and cordon and search. During early stages of planning for this evaluation, the authors and their colleagues met with the small group instructors from the ICCC to discuss methods and procedures for inserting FSC into the program of instruction and for assessing the students' performance as they played the game. Initial plans determined that six computers would be set up to play FSC. Each participant was to play the game for approximately 20 hours during the period of ICCC instruction for operations in urban environments. Furthermore, it was anticipated that small group instructors would use a series of checklists to evaluate how well the students planned and executed their missions, and how well they adapted to emerging threats and conditions.

However, the realities of conducting field research overcame the best of scientifically valid intentions. For one thing, the number of computers that were available and set up to play FSC for any given session varied from two to five. Furthermore, while the small group instructors took part in an initial training session, they were unable to implement any formal evaluation procedures during FSC play. They had to keep the conduct of their seminars on the same schedule as other seminars, and they had to continue participating in the instruction of students who were not playing FSC. They were also unable to maintain a fixed schedule for students to play FSC and could not ensure that students played each of the three different scenarios. In short, there was no formal assessment of performance as students played FSC and no fixed procedures for playing FSC.

One researcher observed the behavior of all students during the FSC train-up and subsequent play. Records were made of the context and the conduct of the FSC playing sessions. The time each student began and ended each experience with FSC was recorded. It was noted when a player modified his plans by creating and implementing a fragmentary order during mission execution. Because the recorded observations of this researcher are the only description of the procedures used during FSC play, they are summarized in the next two paragraphs.

All students in the FSC group were given the FSC User Manual prior to their participation in the initial FSC demonstration and train-up session. During this session, students became familiar with the FSC user interface and with procedures for controlling game functions. Subsequent FSC playing sessions consisted typically of individual students working through a scenario within a fixed time (usually about 60 minutes). On other occasions, students were formed into small groups to work through a scenario, with one student controlling computer functions and others sharing in the planning and execution of the mission. On one occasion, a small group instructor formed two groups of seven students each and instructed them to complete a scenario. Upon completion of the scenario, the instructor determined which group had conducted the best mission. This instructor then conducted a brief after action review based on the plan and execution of the better mission.

One small group instructor specified which scenario was to be played by students in his seminar during each FSC session. The other small group instructor allowed students in his seminar to play any scenario they wanted. Except for the one exercise described in the preceding paragraph, the small group instructors were unable to participate with the students in after action reviews of their FSC play. Further, there were never any attempts by the students to utilize the capabilities of FSC that support an after action review.

Conduct and Observations of Janus Play

The use of Janus to obtain criterion measures of FSC training effectiveness began after students in the FSC group completed playing the game, and after students in both groups completed the ICCC instruction on light Infantry company offensive operations in an urban environment. On each of nine days, one student from both the FSC and the control groups completed a tactical exercise using the Janus simulation. Due to the limited availability of Janus resources only 36 of the 54 students (18 from each group) participated in the Janus exercise. Two steps were taken to accommodate this constraint. First, small group instructors for the FSC

group selected students they thought would be least negatively impacted by missing regularly scheduled classroom instruction and who would most benefit from participating in the Janus exercise. Second, the authors worked in conjunction with small group instructors for the control group to select control students who would be most similar to those from the FSC group in terms of general cognitive ability, decision-making style, and relevant indicators of military experience. One student from one group was scheduled each day for a morning session and one from the other group for an afternoon session. The assignment to a morning or to afternoon session alternated between the two groups. The scheduling of students for the Janus exercise was counterbalanced over successive days to control for possible confounding effects of general cognitive ability.

All students selected to participate in the Janus exercise received a Janus exercise battalion operations order at least one day before their scheduled session. Upon receiving the operations order, students were instructed to read and analyze the order, develop an operations plan for their company, and be prepared to communicate their task organization and their concept of the operation. They were not required to utilize the implements that were used typically for briefing a plan during ICCC instruction (e.g., transparencies, hand-drawn terrain maps, battle boards, etc.).

Upon arriving for the exercise, each student was asked to communicate his task organization and his concept of the operation to the observer/controller. If his observer/controller detected a serious flaw in the student's plan, he reviewed relevant portions of the company operations order with the student and prompted him to make changes. Because of these prompts, most students recognized the need to change their plans and responded by making appropriate changes. Students who elected not to make changes were allowed to continue the exercise with their original plan.[5]

After discussing his company operations order with the observer/controller, the student worked with a Janus programmer who inputted the student's task organization and movement routes into the Janus computer system. Hence, while students had control over the placement and movement routes of all maneuver elements, they did not have to actually control this aspect of Janus play. Instead, they could devote their attention to commanding and controlling their force elements during both the initial setup of these elements and any subsequent changes that they implemented to the original operations order. The input of the initially planned blue force play took from forty minutes to one and one-half hours.

Before beginning mission execution, company assets and call signs were described to the student. For communication purposes, a subject matter expert assumed the roles of all company entities subordinate to the company commander. The student used verbal commands to communicate orders to the subject matter expert, replicating call signs and instructions as if actual radio communications were in effect. The subject matter expert received the verbal commands, responded verbally to established cues, and initiated situation reports in the same

[5] Throughout the Janus exercise, prompting by the observe/controller was used when required to insure that the exercise was a training event.

manner. No radio equipment was used to communicate during the exercise. Mission execution began when the student indicated that his operations order had been correctly entered into the Janus software and that he understood the administrative instructions.

During mission execution, the student, the observer/controller, and the blue force Janus programmer viewed a computer monitor screen that displayed only blue force elements and their intended routes of maneuver on the designated battlefield terrain. On the other side of a partition, a subject matter expert, serving as a role player, and the opposing force Janus programmer viewed another computer screen that displayed only the opposing force elements. The observer/controller and the subject matter expert initiated a series of events (cues) to which the student could respond. All of these events were identified through situation reports given by company subordinates to the student. Upon receiving a report, the student had the opportunity to analyze a potential threat and modify his plan accordingly. The observer/controller evaluated the student's response to each event using the Janus Scenario Assessment Checklist. If the observer/controller suspected that the student did not perceive correctly the need to modify his plan after receiving a situation report, the observer/controller gave a verbal prompt. For example, if a notional scout platoon leader told the student that a mechanized enemy force had been spotted moving toward a key objective area, the student would be required to respond in order to defend or secure that objective. If the student neglected to respond appropriately, the observer/controller would ask questions designed to prompt an appropriately adaptive response. The following questions are examples of these prompts: Do you understand that those enemy mechanized forces are moving at 14 mph? Do you realize that your dismounted troops are traveling at 4 mph? Will the enemy forces arrive at that objective before your forces do? How will that affect your forces in the area? How will that affect your overall mission? After the prompts, the student was free to choose a new course of action or to maintain his current one. The observer/controller rated each response accordingly.

The observer/controller ended the exercise about thirty minutes before the end of the scheduled four-hour session or when the simulated battle was over (i.e., there was a near destruction of friendly or enemy assets, whichever came first). After the student completed a five-minute break, the observer/controller conducted an after action review with the student. Critical events, decisions, and actions were addressed while the student and observer/controller observed a high-speed replay of the mission execution. The observer/controller pointed out strengths and weaknesses of the student's plan and execution, asked doctrinally relevant questions, and allowed the student to respond. Upon completion of the after action review, the student was asked not to discuss his experience with his fellow students. He was then free to leave. The observer/controller then completed his evaluation of the student's performance and wrote a brief summary of the exercise.

RESULTS

The design of this evaluation research called for three sets of analyses: (a) comparisons of measures obtained from officers in the FSC and control groups, (b) an examination of observations during FSC play and ratings by students who played the game, and (c) a study of data pooled over students in both groups. The results of these analyses are presented in the following three major sections. All inferential test statistics presented were determined to be statistically significant when their probability of occurrence was less than or equal to 0.05.

Comparison of FSC Group and Control Group

Except for three aspects of the their military experience (described in the second paragraph below), students in the FSC and control groups were not different with respect to either the pre-FSC measures (i.e., the biographical questionnaire, the test of general cognitive ability, and the decision-making style inventory) or the post-FSC measures (i.e., the decision-making style inventory and performance during the Janus exercise). These results are described in subsequent labeled sections.

Biographical Information

Distributed about equally across the two groups, the mean (and standard deviation) age of the students was 29.6 years (3.7) and their time in service was 8.6 years (4.5). Thirty-two students (59.3%) were Army Infantrymen, seven (12.9%) were from other branches of the Army, three (5.6%) were from the U.S. Marine Corps, and the remaining twelve (22.2%) were international students representing twelve different foreign military services. Thirty-two (59.3%) students were captains and, except for one major (from a foreign service), the others held the rank of first lieutenant. Twenty-nine of the 54 students (55.8%) indicated they had experience with military training simulations and 22 (43.1%) indicated they played commercial computer games. Of the 22 students who played computer games, only four indicated they played games 10 hours or more per week. The mean (and standard deviation) number of hours per week the remaining 18 students reported they played computer games was 3.6 hours (1.8).

Nineteen indices reflecting the type and level of each student's military experience were developed from other responses obtained with the Biographical Information Questionnaire. These indices and the methods used to generate them are given in Appendix Table B-1. There was a significant difference between the FSC and control groups for only three of these indices (see Table 2). The students in the FSC group reported that a higher mean percentage of their (non-student) duty time was spent in company-level assignments than did students in the control group, $F(1, 50) = 3.9$. On the other hand, a higher percentage of students in the control group than in the FSC group reported that they were prior enlisted, $F(1, 50) = 5.15$, and had served in military operations in a foreign country, $F(1, 51) = 4.70$.

Table 2
Military Experience by Group

Group	% Duty Time in Company Echelon	% of Group with Prior Enlisted Service	% of Group with Assignments Outside the U.S.
FSC	25.6 (17.4)	29.6 (4.6)	44.4 (5.1)
Control	16.0 (17.4)	60.0 (5.0)	73.1 (4.5)

Note: Data shown are means (and standard deviations).

The difference between groups for one other measure of military experience approached statistical significance ($p < .07$) but is worthy of description because it is related to one of the

differences shown in Table 2. The students in the control group reported that a higher mean percentage of their (non-student) duty time was spent in assignments below company echelon level than did those in the FSC group. The means (and standard deviations) of this measure for the control and FSC groups were 64.6 percent (28.5) and 52.1 percent (19.6), respectively.

General Cognitive Ability and Decision-Making Style

There was no difference between groups for measures of general cognitive ability or decision-making style. Across the two groups, the mean (and standard deviation) score on the Wonderlic test of general cognitive ability was 23.7 (5.4). The mean (and standard deviation) scale values for the pre-FSC decision-making dimensions of analytic, intuitive, and regret-based emotional styles were 72.8 (7.7), 64.5 (8.5), and 45.9 (11.1), respectively. The corresponding values for post-FSC decision-making style dimensions were 72.5 (8.5), 66.1 (9.0), and 43.0 (10.1).

Measures Derived From the Janus Exercise

The time that elapsed between the start and end of the mission execution phase of the Janus exercise was recorded for each student. The mean (and standard deviation) mission time was 133.1 minutes (38.0). This time did not differ for the FSC and control groups.

Analyses of the three measures of student performance during the Janus exercise failed to find any difference between the FSC group and control group. The grand means (and standard deviations) over the 23 Janus tasks were 80.2 percent (18.2) adaptive responses and 14.9 percent (9.9) prompts. Over both groups, the mean (and standard deviation) number of doctrinal errors committed was 2.2 (2.1).

Observations of Students and Their Reactions to FSC

Behavioral Observations During FSC Demonstration, Train-Up, and Play

One set of observations provided a basis for quantitative analysis of the time each student was involved with FSC. Table 3 shows the amount of time students were exposed to FSC, separately for sessions devoted to demonstrating and preparing the students to play FSC and sessions in which they actually played the game. In the latter case, a distinction was made between instances in which the student was the actual hands-on player of the game and those in which his role was that of an observer (either active or inactive) of game playing activities. During the demonstration and train-up sessions, students were principally observers. The data presented in Table 3 indicate the typical student spent two hours performing hands-on tasks required both to plan the mission and to respond to events that occurred during the mission execution. In addition, he spent about three hours observing others play the game.

Table 3
Student Exposure to FSC (in minutes)

Demonstration and Train-up	Hands-on FSC Play	Observational FSC Play
288 (73)	120 (95)	168 (81)

Note: Data shown are means (and standard deviations).

In addition, it was noted that many students used major portions of the time available for playing an FSC scenario to analyze the battalion operations order and to develop their company operations order. Some students spent considerable amounts of FSC playing time consulting the User Manual. In these cases, there was little time left in the session to complete the mission and to respond to unanticipated events during mission execution.

Responses of FSC Participants on the FSC Questionnaire

Responses to queries in the FSC Questionnaire by 26 members of the FSC group were analyzed separately for each part of the questionnaire. One member of this group did not complete the questionnaire. Separate analyses also were performed to examine the relationship among results obtained from different parts of the FSC Questionnaire and the relationship between results obtained from the FSC and Biographical Information Questionnaires. The findings from these analyses are summarized in subsequent labeled paragraphs.

Involvement in FSC simulated mission environment. Details of the results obtained with this part of the questionnaire are in Appendix Table B-2. Responses to the seven-point rating scale items for involvement indicated that students using the FSC game became personally involved in the simulated command and control environment. Across 24 involvement items, the mean (and standard deviation) rating scale value was 4.6 (0.6). Overall, 57.1 percent of the ratings were restricted to the three most positive values. In contrast, 18.6 percent of the ratings utilized the three most negative values and 24.3 percent used the middle, neutral rating scale category. Looked at in another way, 50 percent or more of the students gave positive responses for 17 of the 24 involvement questionnaire items, a neutral response for six items, and a negative response for only one item.

The extent of their reported involvement was most telling in terms of how quickly they adjusted to the experiences provided by FSC (Item 15, mean scale value = 5.3); how they were able to control events during the planning phase of the mission (Item 1, mean scale value = 5.5); and how their experiences in the FSC environment were affected minimally by extraneous events occurring in or outside the classroom (Item 20, mean scale value = 5.6). Students also indicated they had a compelling sense of moving around inside the FSC environment and that there were moments when they were completely focused on the task of commanding the simulated company mission (Items 11 and 23, respectively, mean scale value = 5.0 in both cases). The ***only*** caveat to the perception of being generally involved in the FSC experience was the one item receiving a negative response (Item 21, mean scale value = 3.0). This response indicated that most students felt they had to focus too much on using the display and control devices associated with the simulation, at the expense of the command experiences being created by the simulation.

Overall training value of FSC. Details of the results obtained for ratings of overall training value of FSC are in Appendix Table B-3. Student responses to the ten items in this part of the questionnaire indicated that they believed using the FSC simulation was a valuable learning experience. Across all ten items, 60.4 percent of the student ratings were restricted to the three most positive values on the seven-point rating scale. In contrast, 18.5 percent of the ratings utilized the three most negative scale values and 21.2 percent used the middle, neutral rating scale category. In other words, the majority of the students gave positive responses to seven of the overall training value items in the questionnaire and a neutral response to the remaining three items.

The questionnaire items receiving the highest mean rating indicated that the students believed it was desirable to use a simulation capability like FSC to experience the possible consequences of executing a tactical plan (Item 10, mean scale value = 5.3), to obtain an opportunity to practice their decision-making skills (Item 2, mean scale value = 5.2), and to have a valuable learning experience (Item 1, mean scale value = 5.0). Students also indicated they were given too little time to use FSC (Item 9, mean scale value = 4.9).

Ratings of involvement in the FSC experience and ratings of overall training value of FSC were shown to be highly related (see Figure 2). The Spearman *rho* statistic yielded a correlation coefficient of .823 for this association. For both statistical and practical reasons, we concluded that a student's level of personal involvement in his FSC experience was positively related to his perception of the overall value of that training experience, and vice versa.

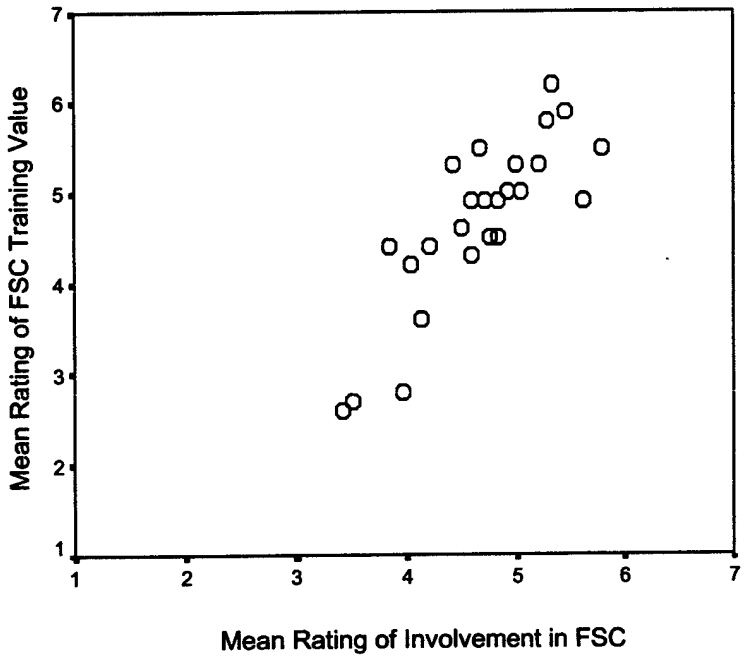


Figure 2. A scatterplot showing the association between ratings of involvement with and overall training value of FSC.

Training value of specific FSC scenarios. Details of the results obtained for ratings of the training value of specific FSC scenarios are in Appendix Table B-4. On the average, 73.6 percent of the students who played a scenario reported that it was challenging. The percentages of students reporting they had learned something new were 35.0 percent for the 20 students who played the reconnaissance scenario, 45.8 percent for the 24 who played the breach scenario, and 63.6 percent for the 11 who played the cordon and search scenario. Of 21 students responding to a follow up question, 38.1 percent indicated the learning unique to the FSC experience was more significant for one scenario than for the other two.

More detailed examination of the data from this part of the questionnaire showed that students reported having different levels of experience with the FSC overall and with each of three FSC scenarios. The number of times a student reported he played any of the three FSC scenarios varied from 2 to 6, and most did not experience all three scenarios. Four students played only the breach scenario. Fifteen played two of the three scenarios (eleven the reconnaissance and breach scenarios, two the cordon and search scenario and the reconnaissance scenario, and two the cordon and search and the breach scenarios). Seven participants reported they played all three scenarios.

It was shown, however, that when the students did play a scenario, they tended to modify their plans for executing the mission in response to emerging battlefield conditions. Across all three scenarios, participants reported they made an average of 2.6 modifications to their initial operational plan when they last played a scenario. However, the number of reported modifications made the last time each student played a scenario varied from none to ten (see Table 4).

Table 4
Number of Modifications Made the Last Time a Scenario was Played

Number of Modifications	Number (Percentage) of Students
0	5 (19.2)
1	4 (15.4)
2	5 (19.2)
3	3 (11.5)
4	5 (19.2)
5	2 (7.7)
6	1 (3.8)
10	1 (3.8)

Note. The numbers of modifications were summed over the three scenarios for each of the 26 students.

The ratings obtained for the training value of specific FSC scenarios were examined further for potential relationships with ratings obtained for involvement in and overall training value of FSC. Three significant and meaningful relationships were found among these data. Students

indicating they learned something new about mission execution with the breach scenario had higher mean ratings for involvement with FSC, $t(22) = 3.95$, and for overall training value of FSC, $t(22) = 3.90$, than those indicating they did not learn anything new from the breach scenario. The mean (and standard deviation) rating of involvement for these two categories of participants were 5.0 (.53) and 4.2 (.45), respectively. The mean (and standard deviation) rating of overall training value were 5.2 (.50) and 4.1 (.87), respectively. Further, students indicating the learning unique to FSC was more significant for one scenario than the others had higher mean ratings for overall training value than those indicating the contrary, $t(19) = 2.62$. The mean (and standard deviation) training value rating for those indicating learning was more significant for one scenario than it was for the others was 5.4 (.53), and for those indicating the contrary it was 4.4 (.93).

Each student was encouraged in the FSC Questionnaire to provide written comments in response to two requests for additional information. If the student indicated he had learned something about mission execution by playing the FSC scenarios that had not been learned otherwise, he was asked to indicate what was learned. Sixteen students provided comments to this request; the comments of ten students had some common themes. Three indicated that FSC taught them synchronization of battlefield assets and another three indicated FSC taught them hasty decision-making. Four additional students indicated that using FSC taught them aspects of maneuver element movement and situational awareness that they had not learned elsewhere in the course.

The second request was directed at the question of whether learning unique to FSC about mission execution was more significant for one scenario than for the others. Eleven students responded to this question; the comments of six students had some common themes. Three remarked that synchronization was more complex for the breach scenario than for other scenarios. Three others indicated that they learned more when scenarios were relatively difficult.

FSC fidelity. Details of the opinions expressed about the fidelity of FSC portrayal of simulated events are in Appendix Table B-5. Most students (70.6%) indicated all four types of fidelity for FSC visual displays were important. Most students (88.0%) also indicated that the fidelity of the FSC displays was adequate to excellent, though the mean rating on a 5-point scale for the goodness of blue force fidelity (3.1) was lower than it was for enemy force, physical, or psychological fidelity (3.5, 3.6, and 3.4, respectively). When asked to rank order the relative importance of these four types of fidelity, most participants (87.5%) gave blue force fidelity the highest two ranks of 1 or 2. The mean rank assigned to blue force fidelity was 1.2, while that for the other three was 2.7, 2.9, and 2.8).

The data obtained for the ratings of FSC fidelity were examined further for their relationship with ratings for involvement in and overall training value of FSC. Four meaningful and significant relationships were identified. Ratings of the goodness of the blue force tactical fidelity were positively related to involvement in FSC (Spearman's *rho* = .503) and to perceived training value of the game (*rho* = .683). Ratings of psychological fidelity also were positively related to involvement (Spearman's *rho* = .437) and to training value (*rho* = .654).

Each student was encouraged in this part of the FSC Questionnaire to provide written comments that described FSC features that supported his assessment of the importance or quality of each of the four types of fidelity. Fifteen to nineteen students provided written comments to these four queries. The content of these comments was quite varied and seemed to be driven by the wording of the definitions provided for each type of fidelity in the FSC Questionnaire. While seven or more students indicated that the physical environment and the enemy force activities were realistic, up to nine wrote comments indicating improvements were needed in the portrayal of blue force movement and the responsiveness of blue force to commands given in an operations or fragmentary order. At least three students indicated that the following enemy force events and actions were unrealistic: They always fight to the death, they did not respond to blue force troops within line of sight, and they were not challenging enough or their formations were too basic. The issue concerning psychological fidelity cited most frequently related to the frustrations experienced during mission execution, and the most frequent source of frustration involved various types of software failures.

Capability to perform ICCC action items using FSC. Details of the responses received in this part of the questionnaire are in Appendix Table B-6. FSC was designed and developed to permit the students to perform 22 action items or tasks derived from the ICCC lesson on light Infantry offensive operations in an urban environment. Overall, a majority of the students (69.1%) indicated they could perform these action items moderately well or very well (the two highest rating scale categories in a four-point rating scale). The mean (and standard deviation) rating scale values of the five highest rated action items were: Develop a course of action for a light company team, 3.5 (0.6); Determine own force potential combat power, 3.3 (0.7); Select a course of action, 3.3 (0.6); Analyze enemy situation, 3.2 (0.7); and Issue a frago (a fragmentary order), 3.2 (0.8). Several action items were not performed using the FSC. The mean (and standard deviation) rating scale values for the three lowest rated action items were: Analysis of civilian considerations, 2.0 (0.9); Issue a company/team OPORD (operations order), 2.2 (0.7); and Issue an OPORD for Infantry company, 2.2 (0.8). When asked to indicate whether these 22 design capabilities of the FSC simulation should be kept in future versions of the simulation, the students generally responded in the affirmative. Averaged over all 22 action items, 98.7 percent of the participants indicated the current design features of FSC should be retained in future versions of the game.

Additional ICCC actions Items that should be incorporated in future versions of FSC. Details of the ratings and rankings provided in this part of the questionnaire are in Appendix Table B-7. Overall, 66.4 percent of the students indicated they believed future versions of the FSC simulation should permit performance of 17 listed ICCC action items that were not currently programmed into the game. However, the participants were quite discriminating in this assessment. A very high majority (88.0% or more) indicated future versions should incorporate the three following ICCC action items: Apply emerging threat operations to tactical planning, Defend a company/team battle position, and Plan offensive fire support for a mechanized Infantry company/team. On the other hand, fewer than 33 percent of the students elected ***not*** to endorse the incorporation of two action items into future versions of FSC. These items were: Conducting TEWT (training exercise without troops) and Constructing a company METL (mission essential task list).

Common responses to open-ended questions in the FSC Questionnaire. A series of questions in the last part of the FSC Questionnaire asked students to provide written comments to address three broad areas of concern. The comments received are summarized in the following numbered paragraphs.

(1) *Does high quality training using FSC depend on an experienced instructor? Can you learn as much using FSC on your own?* The objective of these two questions was to ascertain whether students thought they could receive high quality training by playing the FSC game on their own, without the assistance of the small group instructor or other subject matter experts. However, it was evident that the students responded to these questions in the context of only the initial demonstration and train-up session. Thirteen of the 25 students who answered this question indicated that training to use FSC would be difficult without an experienced instructor and twelve said they could learn to play FSC on their own. From these responses, it is unclear if they felt they could have learned more about mission execution if an instructor were present during subsequent sessions devoted to playing FSC.

(2) *Identify what you most liked and what you most disliked about the following specific aspects of FSC. (a) The user manual*: While ten participants indicated the user manual was either easy to use, clear and complete, or user friendly, three other students indicated the user manual needed either more examples, greater depth, or more pictures, and another six reported they never used the manual. *(b) The training provided for using FSC*: Three said they had enough time with the game and it was easy to use, but twelve indicated they did not have enough time to play the game. *(c) The interface with FSC during mission planning and during mission execution*: Eight students most liked the planning phase of the game and four most liked being able to implement fragmentary orders during mission execution, but three each most disliked the fact that the allocation of combat power could not be changed without restarting the entire planning phase and the requirements associated with using planning codes ("go codes") to determine the timing of blue force movements. (d) Finally and more generally, *identify three features you liked best and three features you liked least about FSC*: While the best liked features of FSC by at least four students each were the graphics and the realistic training provided by FSC, the least liked feature of the game by three students each were that blue force Soldiers did not respond properly or realistically, situation reports were incomplete or not available when needed, and software failed during mission execution.

(3) In spite of the possible limitations you may have encountered with FSC, what are its advantages or potential for improving the decision-making skills of individuals in ICCC? Twenty-four students provided written responses to this question. Four mentioned that the FSC facilitated appropriate decision-making during planning and mission execution. Five students mentioned the importance of experiencing the planning and execution phases. At least two each listed the following: the advantages of training basics being reinforced with FSC, the chance to respond to unforeseen events, being able to implement fragmentary orders, making low-cost mistakes, synchronization of assets on the battlefield, or using FSC to train junior leaders.

Comparison of FSC Ratings for Involvement and for Overall Training Value with Pre-FSC and Post-FSC Measures

Mean ratings obtained for involvement and for overall training value were examined for possible relationships with the pre-FSC and post FSC measures. There were no relationships found between these two FSC Questionnaire variables and pre-FSC measures of general cognitive ability, pre-FSC and post-FSC measures of decision-making style, or post-FSC measures of Janus performance. However, four significant and meaningful relationships were found involving pre-FSC measures obtained with the biographical questionnaire. As shown in Table 5, the higher the participants' percentage of duty time in company-level assignments, the higher their mean ratings for involvement with and overall training value of FSC. In contrast, the higher the participants' percentage of duty time spent below company echelon, the lower their mean ratings for these two parts of the FSC Questionnaire.

Table 5
Association of FSC Ratings with Biographical Data

Percentage Duty Time	Mean FSC Involvement Rating	Mean FSC Overall Training Value Rating
At Company Echelon	+0.413	+0.460
Below Company Echelon	-0.417	-0.537

Note: Associations were quantified using Spearman's *rho* correlation coefficients.

Description of Other Results Pooled Over FSC and Control Groups

Additional results were found by pooling over the data collected from students in the FSC and control groups. While these results are not relevant to the evaluation of FSC training effectiveness, they are of value for developing a better understanding of the meaning and interrelationship of the various measures obtained during the evaluation. They are reported here because they may be of benefit for future research in this and related areas, as well as for military personnel responsible for the training of small group leaders.

Measures of Performance During the Janus Exercise

Several potential relationships involving the performance of the 36 students who participated in the Janus exercise were examined using Spearman's correlation coefficients. Results showed two significant relationships among the three Janus dependent variables. As the mean percentage of adaptable responses in the Janus exercise increased, there was a decrease in the percentage of trials on which a prompts was provided (Spearman's *rho* = -.351) and in the overall number of tactical errors (*rho* = -.750).

Potential relationships between dependent measures from the Janus exercise and pre-FSC and other post-FSC measures were also examined. Only three meaningful and significant results emerged from these analyses, all involving items from the biographical questionnaire. As the percentage of duty time at the company level increased, the percentage of adaptable responses

for Janus tasks increased, *rho* = .372, but as the percentage of duty time assigned to positions below company level increased, the percentage of adaptable responses decreased, *rho* = -.331. It was also shown that as the percentage of duty time assigned to positions below company level increased, the number of doctrinal errors during the Janus exercise increased, *rho* = .330.

Measures of General Cognitive Ability and Decision-Making Style

The measure of general cognitive ability was not meaningfully or significantly related to any other variables considered in this research. The median score on the Wonderlic Personnel Test by participants in this research (25) is higher than that obtained by high school graduates (21), but lower than that obtained by college graduates (29), where both of the latter normative scores were determined from research using large samples of participants from many organizations across the U.S. From a purely measurement perspective, it must be noted that the correlation coefficients found among the measures of general cognitive ability and types of decision-making style were not found to be significant.

Paired sample t-tests were used to compare the pre-FSC and post-FSC measures of the three decision-making styles. These tests showed a difference for only the regret-based emotional style of decision making, $t(53) = 2.37$. The mean (and standard deviation) scores were 45.9 (11.1) on the pre-FSC measure and 43.7 (11.2) on the post-FSC measure. Averaged over pre-FSC and post-FSC measures, the mean scores of students for the analytic decision-making style (72.6) and the intuitive style (65.3) were higher than those reported by Nygren (2000) for a large sample of college students (64.8 and 61.3, respectively). On the other hand, the pre-FSC measure of regret-based emotional decision-making style (45.6) was lower than that for Nygren's sample (58.5), and it was even lower (43.0) after about 9 weeks of instruction in the ICCC.

Other meaningful and significant relationships were found between measures of decision-making style and measures derived from the biographical questionnaire, but only for the regret-based emotional style of decision making. For 51 students providing useful data, regret-based emotional decision style was negatively correlated with the percentage of duty time spent at echelons below company level (*rho* = -.344 for the pre-FSC measure and -.373 for the post-FSC measure). On the other hand, regret-based emotional decision style was positively related to the percentage of duty time spent in a staff position (*rho* = .349 for the pre-FSC measure and .379 for the post-FSC measure). Finally, for the 22 participants who reported spending non-zero time playing commercial computer video games, the regret-based emotional decision style was negatively correlated with the reported number of hours spent playing computer video games (-.602 for the pre-test measure and -.659 for the post-test measure).

DISCUSSION

Results Related Directly to FSC Training Effectiveness

The officers who played FSC generally endorsed the use of this computer-based game for the course. Through their responses to items in the FSC Questionnaire, these officers indicated

(a) they became personally involved in the game's simulated mission environment, (b) the three types of scenarios they played were challenging, (c) the fidelity or realism of simulated battlefield events and actions was quite good, and (d) playing the game permitted them to practice many of the action items or tasks that would enable them to meet the objectives of the course. Given these generally favorable opinions of the game's attributes, it was not surprising that they expressed highly positive opinions concerning the overall training value of FSC.

However, there also were some caveats in the ratings provided by those who played FSC. The majority indicated (a) they had to focus their attention on their interactions with the game's display and control devices rather than on the experiences being created by the game, (b) they did not have sufficient opportunities to adapt to uncertain conditions during simulated tactical missions and (c) playing FSC did not necessarily permit them to learn anything about mission execution that they had not learned otherwise. The last indicated opinion was especially evident for the two game scenarios that were played most often by most of the participants.

The implications of these ratings about FSC need to be judged in the context of the current state of game development. The version of FSC available for use in this research was, after all, the initial release of the game software and should be considered a prototype. When asked to do so, most participants indicated that future versions of the game need to include capabilities for actions, such as defensive operations and the use of fire support, that were not built into the current version of FSC.

Perhaps most troubling for this evaluation of the training effectiveness of FSC was the failure to find any statistically reliable differences in Janus performance between officers who played the game and those who did not. It was anticipated that participants who had additional training opportunities with FSC would demonstrate superior adaptive decision-making ability during the Janus exercise. This clearly was not the case. However, several of the more salient reasons for there being no difference between these two groups are unrelated to the potential training value of playing FSC. For instance, it might be argued that the Janus exercise was not a valid measure of an officer's ability to plan and execute a simulated mission. We reject this potential explanation. The Janus exercise was created specifically for our evaluation research and was uniquely designed to assess a player's ability to adapt his decision making to emerging battlefield conditions.

We argue that the most obvious reasons for finding no group difference in Janus performance was the limited opportunity for participants to play the FSC game and the absence of controlled procedures for using the game. Observations during sessions devoted to playing FSC underscored both the limited time available for individuals to actively play FSC and the varying procedures used for controlling which scenarios were played during any given session. Likewise, ratings and written responses by officers in the FSC group showed that they believed they did not have enough time to play FSC. [6]

---

[6] We wish to emphasize that the absence of controlled procedures for using FSC and the limited amounts of time available to play FSC were due to constraints in the ICCC POI, and not to any failure on the part of those responsible for the ICCC program or the small group instructors responsible for the seminars in which FSC was introduced.

Another major shortfall in the procedures used for playing FSC was the general absence of any form of structured evaluation of the game player's decision-making performance. Army training doctrine states that all training must be evaluated to measure performance levels against established Army standards and to establish whether the training standard has been achieved. Indeed, the Army's capstone training publication, *Field Manual 7.0, Training the Force* (DA, 2002), goes so far as to state: "Training without evaluation is a waste of time and resources" (p. 6-4). The after action review is a common method for evaluating training. It is a structured process incorporating coaching and mentoring provided by an experienced instructor. The after action review allows participating Soldiers to discover for themselves what happened during the training, why it happened, and how it can be done better. Due principally to constraints built into the ICCC program of instruction, the extensive after action review capabilities built into FSC were never used by the game players. However, it must be noted that the developers of FSC did not intend the after action review function to be used solely by the player. The User Manual indicates that it was to be used by both the player and the instructor to examine the execution of the mission in detail, and to analyze and evaluate the decisions made by the player.

Results Related to Other FSC Training Issues

The results of our research highlight a variety of general training issues, quite apart from the issue of the game's training effectiveness. For example, FSC players indicated the three tactical scenarios used during this research provided opportunities for different levels and different types of involvement and learning experiences. There was little evidence, however, that these scenarios were designed to vary systematically the difficulty of the required decision-making process. In future versions of FSC-type games, care should be taken to identify what specific types of decisions and types of decision-making requirements are imposed by the various scenarios used to drive the command and control function. If this were done, the training needs of students could be matched by the training opportunities provided by particular scenarios.

Another factor highlights the issue of the fidelity or realism of battlefield events and actions portrayed in FSC. The game players' responses to queries about different types of fidelity showed that the artificial intelligence software that determines actions of the blue force is more important than the quality of visual graphics used to portray physical features of the environment or characteristics of the opposing threat force. For purposes of training decision-making skills, doctrinally accurate portrayal of the blue force responses to orders of the commander and of tactically significant environmental factors must take precedence over concerns for other purely physical features of the displayed battlefield.

Another training issue addressed by the results of our evaluation is the capability of FSC to train for the deliberative planning that occurs before a mission is initiated, as well as for the hasty planning that occurs while a mission is being executed. As currently developed, FSC requires that the participant both create his operations plan and monitor the execution of the plan. Monitoring the execution of the operations plan is necessary to acquire the insights needed to develop and issue fragmentary orders rapidly to change the original plan. Observations made while FSC was being played showed that during many time-limited sessions, some game players spent so much time planning a mission that there was little if any time left to execute the mission. Much of the time required to develop an operations plan was due to a lack of

familiarity with how to do so in the FSC game-playing environment. However, the acts of analyzing a mission and developing an operations plan are inherently time-consuming cognitive processes that can be learned using other pedagogical methods that already exist.

We believe the FSC's unique potential contribution to training future company commanders is not to augment the ***knowledge-based*** instructions already adequately provided. In fact, the company command segment of the ICCC is already structured to provide classroom instruction and practical exercises designed to teach students how to develop tactically and doctrinally sound operational plans and to issue operations orders for an Infantry company. Rather, we believe the player of FSC should be given the opportunity to learn ***experientially*** about the possible consequences of executing an operations order and making hasty changes to that order. Experiential learning builds on previous knowledge and is a prerequisite for the development of tactical expertise. Future versions of FSC could consider an optional mode of play that does not require the act of deliberately planning a mission. Rather, the player might simply be given an operations order prepared in advance to highlight specific training objectives (i.e., decision points and their potential consequences). The objective for the player would then be to monitor the execution of that operations order to acquire skills necessary for making the hasty decisions required to respond to unanticipated conditions of the battlefield environment. Using such an option, the number of experiential learning opportunities for the FSC player would increase substantially over what is now possible.

A final training issue raised by this research is related to whether FSC is equally well suited for all students in an ICCC class. The results are quite clear in showing that the participants' ratings of involvement in and overall training value of FSC was positively related to the percentage of their reported duty time in company-level assignments and negatively related to the percentage of their duty time in assignments below company echelon. These results suggest that the training value of FSC may vary with the military experience players bring to ICCC. If true, these results suggest that, at a minimum, the relative difficulty of mission scenarios should vary to accommodate the varying backgrounds of the students. For example, scenarios could vary the number of assets that the student has while he plans and executes a mission (e.g., fewer assets than the three Infantry platoons and mortar section typically available to an Infantry company commander). Indeed, it could be useful to create a platoon leader version of FSC. At the other extreme, scenarios could increase the number of assets whose actions need to be monitored and synchronized and otherwise increase the complexity of the battlefield environment. In any case, the goal would be to provide a student initially with a level of complexity that matches the breadth and depth of his military experience. Then, in line with the crawl-walk-run approach of training challenges, the difficulty, uncertainty, and realism of the scenario could be increased as the student gains mastery of successively more complex missions that demand an expert company commander's vision of the battlespace.

Results Related to Measurement Issues

Finally, several of the methods employed during this research yielded results that suggest they need to be further investigated for their potential value during future evaluations of computer games. For example, the use of the Janus Scenario Assessment Checklist in this research permitted a direct assessment of a player's ability to adapt to changing and uncertain battlefield conditions. The same types of decision-making assessment techniques need to be

developed for FSC. The direct measure of decision-making adaptability can serve to calibrate the quality and amount of training acquired by students, as well as measure the capability of these players to transfer the skills they have learned to other simulated or live tactical environments. While Janus is a resource intensive method for assessing training effectiveness, its use is required only during relatively short-duration evaluations of much longer-term efforts to design and develop training methods. Furthermore, the development and use of additional objective criterion measures, such as those that track the timing and sequencing of adaptive decisions, would still further enhance the value that can be derived from these types of methods for evaluating training effectiveness.

While a measure of general cognitive ability was not shown to be useful for predicting the effects of playing FSC, there is some suggestion that measures of decision-making style could prove to be of value. The fact that measures obtained for the three types of decision-making style were mutually independent suggests that individuals may score differently on one scale than the others. There is considerable discussion in Army doctrine for the distinction between analytical and intuitive styles of decision making. *Field Manual 6.0, Mission Command: Command and Control of Army Forces* (DA, 2003), specifies that both styles of decision making are useful. That publication also notes it may be appropriate to shift from more analytical styles in deliberative decision-making situations to more intuitive styles during situations that require hasty decision making. Participants in our research scored initially quite high on measures of their propensity to use analytical and intuitive decision-making styles. Consequently, there may have been a "ceiling effect" with the Decision Making Style Inventory that lessened the chance for post-FSC measures to show an increase for either of these decision-making styles. Furthermore, there were too few participants to permit contrast of those who score high or low on each of the three scales for decision-making style. Other methods (e.g., the Adaptive-Innovation scale developed by Kirton, 1994) need to be examined for their relevance in examining different styles of decision-making and to evaluate training methods to optimize the use of different styles.

The fact that measures for the regret-based emotional decision-making style tended to decrease during the company command segment of the ICCC suggests that the course achieves one of its objectives. After just ten weeks in the course, students seem to acquire a greater propensity for making decisive decisions without experiencing excessive doubt about their actions or dwelling excessively upon the risk associated with them. The relationships found between measures of regret-based emotional style of decision making and the number of hours spent playing commercial video games is quite interesting and may, in part, serve to validate measures obtained using the scale. The relationship suggests that regret-based emotional individuals, who tend to score high in both personal and judgmental self-doubt and low in risk seeking and self esteem, spend relatively little time playing video games, and vice versa. Those who never play video games have a much higher range of regret-based emotional style scores. Indeed, a point worth emphasizing is the fact that the majority of the participants in this research reported that they never play video games. The more commonly held opinion, that most Soldiers spend many hours playing video games, is given as one justification for promoting the adoption of video games as a method for training cognitive abilities required of Soldiers.

A final point needs to be made for investigating further the value of determining an officer's propensity for engaging in a regret-based emotional style of decision making. Officers in our research who had spent relatively large amounts of time in assignments below company level scored low on the regret-based emotional scale, suggesting they would tend to score high in risk taking and self esteem and low in both personal and judgmental self-doubt. In contrast, officers who have spent relatively large amounts of time in battalion or brigade staff positions scored high on the regret-based emotional scale, indicating they would tend to score low in risk taking and self esteem and high in both personal and judgmental self-doubt. Clearly, these results suggest the assignment history of officers may influence their predominant styles for decision making, and that in turn could affect the methods and procedures most appropriate for training adaptive decision-making behaviors.

CONCLUSION

The absence of statistically reliable differences in criterion measures of adaptive decision-making behaviors between participants who played FSC and a control group of participants who did not play FSC would be accepted generally as evidence that FSC did not contribute to officers' acquisition of requisite cognitive skills. However, the failure to find differences between groups for this criterion-based measure of training success is more likely due to constraints in the time available and the procedures used for playing the game rather than to some fault in the game itself. Officers participating in our research clearly did not have sufficient time for playing FSC. In addition, because these officers did not participate in any form of performance evaluation after they played FSC, it is impossible to determine objectively what, if anything, was learned while playing the game.

While shortcomings in experimental procedures may have been confounded comparisons between participants who played FSC and those who did not, officers in the FSC group had enough exposure to the game to form definitive opinions about it and its value for training. The results suggest that these officers believed FSC provided them with experiences that were of value both to themselves and to other students in the ICCC. Opinions expressed by officers who played FSC also identified specific changes that should be made in future versions of the game. In addition, other measures showed the amount and types of military experience acquired prior to enrollment in the ICCC were related to measures of perceived involvement, training value, adaptive decision-making behavior, and decision making style. These latter findings suggest that future versions of FSC-type computer games should consider differences in experiences the player has previously acquired during his military career.

REFERENCES

Department of the Army (2002). *Training the Force* (Field Manual 7.0). Washington, DC: Author.

Department of the Army (2003). *Mission Command: Command and Control of Army Forces* (Field Manual 6.0). Washington, DC: Author.

Dodrill, C. B. (1983). Long-term reliability of the Wonderlic Personnel Test. *Journal of Consulting and Clinical Psychology, 51*(2), 316-317.

Dodrill, C. B., & Warner, M. H. (1988). Further studies of the Wonderlic Personnel Test as a brief measure of intelligence. *Journal of Consulting and Clinical Psychology, 56*, 145-147.

Grotte, J. H., Christenson, W. M., Roberson, M. R., Daley, M. K., Craig, K., & Samita, K. (July, 1995). *Distributed Janus Including: System Administration Manual, Operator's manual, User's manual, Exportable Training Document* (IDA Document D-1626). Alexandria, VA: Institute for Defense Analysis. (DTIC Accession Number ADA300221)

Kirton, M. J. (1994). *Adaptors and Innovators: Styles of creativity and problem solving* (Revised Edition) Hertfordshire, England: KAI Distribution Centre.

Nygren, T. E. (2000, November). *Development of a measure of decision making styles to predict performance in a dynamic judgment/decision making task.* Paper presented at the 41st Annual Meeting of the Psychonomics Society, New Orleans, LA.

Nygren, T.E., & White, R. J. (2002). *Assessing individual differences in decision making styles: Analytical vs. intuitive.* In the Proceedings of the Human Factors and Ergonomics Society 46th Annual Meeting (pp. 953-957).

Singer, M. J., & Witmer, B. G. (1996). *Presence measures for virtual environments: Background and development.* (Unpublished research note) Orlando FL: Simulator Systems Research Unit of the U.S. Army Research Institute.

White, R. J., & Nygren, T. E. (2002). *Influence of analytically and intuitively framed instructions upon multi-attribute decision task approach.* In the Proceedings of the Human Factors and Ergonomics Society 46th Annual Meeting (pp. 497-500).

Witmer, B. G., & Singer, M. J. (1994). *Measuring Presence in Virtual Environments* (Technical Report 1014). Alexandria, VA. The U.S. Army Research Institute for Behavioral and Social Research. (ADA286183)

Witmer, B. G., & Singer, M. J. (1998). Measuring presence in virtual environments: A presence questionnaire. *Presence, 7*(3), 225-240.

Witmer, B. G., Singer, M. J., & Jerome, C. (in press). The factor structure of the presence questionnaire. *Presence.*

APPENDIX A

MEASUREMENT INSTRUMENTS USED DURING THE TRAINING EFFECTIVENESS EVALUATION OF FSC

Biographical Information Questionnaire

Name_____

Please fill in the blanks or check the appropriate responses.

1. What is your age? Years_____

2. What is your rank? _____

3. Source of Commissioning? (Check one) ROTC____ OCS____ USMA____
Direct Commission____ Other_____

4. Time in service: Years_____ Months_____
Time in rank: Years_____ Months_____

5. If you are Army, what is your branch, and if not Army, what is your service? _____

6. If Infantry, what percentage (0 to 100%) of your Infantry experience is Mechanized? _____%

7. If Infantry, have you been awarded the Expert Infantryman Badge? Yes_____ No_____

8. Beginning with your assignment before coming to ICCC, identify the duty positions you have held, the units in which you held these positions, and the duration of the assignments.

Duty Position	Unit Designation	Location of Unit	# Months in Duty Position

9. What Army training courses have you completed? Check all that apply.
Airborne_____ BFV Leader Course_____ Ranger_____ Air Assault_____
IMPOC_____ Pathfinder School_____
Other(s) _____

10. Were you prior enlisted? Check "Yes" or "No." Yes_____ No_____
If "Yes," which NCO course(s) did you complete? Check all that apply.
PLDC_____ BNCOC_____ ANCOC_____
Other(s) _____

11. Have you been on a rotation to any of the following combat training centers?

Combat Training Center	Check "Yes" or "No"	If "Yes," what was your duty position?	If "Yes," did you take part in live fire exercises? Check "Did" or "Did Not
JRTC	Yes__ No__		Did__ Did Not__
NTC	Yes__ No__		Did__ Did Not__
CMTC	Yes__ No__		Did__ Did Not__

12. Have you had experiences in military operations Outside the Continental United States? Check "Yes" or "No." Yes_____ No_____

If "Yes," indicate the location of these experiences by checking all the options that apply and then provide the other information requested. If "No," go directly to the next item (#13).

Location	Duty Position	Duration (Months)	Combat Experience	Stability Ops Experience
____**Afghanistan**			Yes ___ No ___	Yes ___ No ___
____**Bosnia**			Yes ___ No ___	Yes ___ No ___
____**Kosovo**			Yes ___ No ___	Yes ___ No ___
____**Desert Storm**			Yes ___ No ___	Yes ___ No ___
Other(s) _____			Yes ___ No ___	Yes ___ No ___
_____			Yes ___ No ___	Yes ___ No ___
_____			Yes ___ No ___	Yes ___ No ___

13. Have you had prior experience with the following events? Check all that apply.

Event	Platoon Level	Company Level	Bn Staff Level
ARTEP or external evaluator.			
Command of a unit undergoing an ARTEP or external evaluation			
Coordination with engineers			
Coordination with medics.			
Coordination with armor unit.			
Combined arms live-fire exercise.			
In charge of mortar live-fire.			
Ground-to-air coordination (fixed wing).			
Ground-to-air coordination (rotary wing).			
Calling artillery rounds.			
Coordination with a forward observer			
Responsible for casualty evacuation (plan or execution).			
Issuing orders.			
Logistical support.			

14. Have you had experience with military training simulations (Janus, CCTT)? Yes___ No___
If "Yes," please describe briefly or give the names of the simulations.

15. How many hours per week do you play commercial computer games? ____ hours per week
List the games you play (e.g., Civilization, Delta Force, Rainbow 6)

16. Is there any other military experience we have not covered? [Use reverse side of this page if more room is needed to write.]

[Thank you for completing this questionnaire]

Decision-Making Style Inventory

Name_____

We are interested in how you typically go about making decisions. Think about different situations and contexts in which you have made decisions recently. Then, using the 6-point scale shown below, indicate the degree to which you agree or disagree with each numbered statement. Keep in mind that there are no right or wrong answers to any of these items, because there is no single "best" way to make every decision. It is important that you try to answer all questions. However, if you feel uncomfortable with any item, you may choose to omit it.

1 Strongly Disagree	2 Moderately Disagree	3 Slightly Disagree	4 Slightly Agree	5 Moderately Agree	6 Strongly Agree

1 ____ I feel that if I plan my decisions carefully I will make good decisions.

2 ____ In spontaneous decision situations I usually find that I have good intuitions.

3 ____ I think that I could keep myself from worrying later if I had made a bad decision.

4 ____ In making decisions I first try to make a mental list of all the factors or attributes that will be important to my decision.

5 ____ I can get a good "feeling" for most decision situations very quickly.

6 ____ I sometimes spend too much time hesitating before making decisions.

7 ____ Before I make a decision, I like to figure out the most efficient way of studying it.

8 ____ I feel that I have a knack for making good, quick decisions.

9 ____ Before I make a decision, I think about whether others will approve or disapprove of it.

10____ I'm very rational when it comes to evaluating risky options.

11____ I think that relying on one's "gut feelings" is a sound decision making principle.

12____ I tend to be someone who worries a lot over decisions I've made.

13____ In making decisions I first make a careful initial estimate of the situation.

14____ There are many common sense "rules-of-thumb" that I know of that usually lead to good decisions.

15____ After making a decision, I find that I often go back and re-evaluate the situation.

16____ I try to pay attention to past information in making new decisions.

17____ Sometimes decisions, even important ones, are not difficult to make because they just "feel" right.

18____ I have trouble putting the results of disappointing decisions I've made behind me.

19____ A good rule of thumb is that the more information I have in making a decision, the better that decision will be.

20____ Simple decision rules usually work best for me.

21____ I rarely rehash old decisions I've made.

22____ In making decisions I try to evaluate the importance of each piece of information in the decision process.

[Please continue on next page]

Continue to use the following rating scale for each statement

1 Strongly Disagree	2 Moderately Disagree	3 Slightly Disagree	4 Slightly Agree	5 Moderately Agree	6 Strongly Agree

23____ When forced to make a quick decision, I find that information that readily comes to mind is usually the most useful in making a choice.

24____ Worrying about future decisions that I have to make is something I often do.

25____ I always try to be fully prepared before I begin working on making a decision.

26____ My first reaction to a decision situation usually turns out to be the best one.

27____ Many times when I look back on a choice I've made, I wish that I would have put more effort into evaluating the alternatives.

28____ In making decisions I try to examine the importance of the good and bad points of each alternative.

29____ If I can't decide what to do, I go with my "best guess".

30____ When I find out that I've made a bad decision I feel a lot of regret.

31____ I like to take a rational, systematic approach to making decisions.

32____ When making decisions, my first instinct usually turns out to be best.

33____ If I were gambling at a casino I would prefer to play simpler games like slot machines where you don't have to concentrate on playing complex strategies.

34____ My best decisions are those for which I've carefully weighed all of the relevant information.

35____ I let my intuition play a big part in most decisions I make.

36____ I generally don't make very good decisions under time pressure.

37____ I generally rely on careful reasoning in making up my mind.

38____ I often rely on my first impression when making a decision.

39____ I sometimes get "butterflies" in my stomach when I have to make decisions.

40____ I like to make decisions in an orderly manner.

41____ I rely on my intuition in making many of my personal decisions.

42____ After making a decision I sometimes worry about the regret I'll feel if it the outcome turns out to be a bad one.

43____ Most important decisions in life are complex and need to be evaluated in a systematic way.

44____ I find that my best decisions usually result from using the "quick and easy" approach rather than the "slow but sure" method.

45____ Unexpected bad outcomes have a greater impact on me than do unexpected good outcomes.

[Thank you for completing this inventory.]

Full Spectrum Command Questionnaire

Name_____ **Date**_____

Based on your experience executing missions with Full Spectrum Command (FSC), respond to the questions in Parts 1 and 2 of this questionnaire by marking an "X" in the appropriate box of the 7-point scale. Please consider the entire 7-point scale before making your responses.

Part 1. Involvement in the FSC Simulated Mission Environment

1. How much were you able to control events during the planning phase of the mission?

NOT AT ALL			SOMEWHAT			COMPLETELY

2. How much were you able to control events during the execution phase of the mission?

NOT AT ALL			SOMEWHAT			COMPLETELY

3. How responsive was the FSC environment to actions that you initiated?

NOT RESPONSIVE			MODERATELY RESPONSIVE			COMPLETELY RESPONSIVE

4. How natural did your interactions with the FSC environment seem to be?

EXTREMELY ARTIFICIAL			BORDERLINE			COMPLETELY NATURAL

5. How involved were you with events in the FSC environment?

NOT AT ALL			SOMEWHAT			COMPLETELY

6. How natural were the processes that controlled movement through the FSC environment?

EXTREMELY ARTIFICIAL			BORDERLINE			COMPLETELY NATURAL

7. How completely were you able to actively survey or search the FSC environment?

NOT AT ALL			SOMEWHAT			COMPLETELY

8. Were you able to anticipate what would happen next in response to the actions that you initiated?

NOT AT ALL			SOMEWHAT			COMPLETELY

[Continue on next page]

9. How much did your experiences in the FSC environment seem consistent with your real world experiences?

10. How compelling was your sense of people and objects moving through space?

11. How compelling was your sense of moving around <u>inside</u> the FSC environment?

12. How well could you observe and examine people and objects from multiple positions in the simulated battlefield environment?

13. How well could you move or manipulate objects in the FSC environment?

14. How involved were you in the experiences provided by the FSC environment?

15. How quickly did you adjust to experiences provided by FSC?

16. How proficient did you feel moving in and interacting with the simulated environment at the conclusion of your experiences with FSC?

17. How much did the quality of the visual display interfere or distract you from performing necessary tasks or required activities?

[Continue on next page]

18. How much did the input or control devices interfere or distract you from performing necessary tasks or required activities?

19. How well could you concentrate on performing necessary tasks or required activities rather than on the mechanisms used to perform those tasks or activities?

20. To what extent did events occurring in or outside the classroom distract from your experiences in the FSC environment?

21. Overall, how much did you focus on using the display and the control devices rather than on the experiences created by FSC for commanding a company mission?

22. Were you so involved in commanding the simulated mission that you lost track of time?

23. Were there moments during your experience with FSC when you felt completely focused on the task of commanding a company mission?

24. How did the total duration of a mission execution affect your sense of involvement in the FSC experience?

[Continue on next page]

Part 2. Overall Training Value of FSC

1. Was using FSC a valuable learning experience?

2. Did FSC provide the opportunity to practice your decision-making skills?

3. Did FSC allow you to focus on the critical factors that influenced decision-making during simulated tactical operations?

4. Do you think your training with FSC will improve your ability to make **rapid** decisions during future tactical operations?

5. Do you think your training with FSC will make you more confident in your ability to make **appropriate** decisions during future tactical operations?

6. How many opportunities did FSC give you to adapt to uncertain conditions during simulated tactical operations?

7. Do you think your training with FSC will make you more confident in your ability to adapt to uncertain conditions during future tactical operations?

8. How challenging were the overall experiences provided by FSC?

[Continue on next page]

9. How would you describe the amount of time you spent using FSC?

10. How desirable is it to use a simulation capability like FSC to experience the possible consequences of executing a tactical plan?

[Continue on next page]

Part 3. Training Value of Specific FSC Scenarios

Answer the questions in the table below by circling the appropriate alternative.

Question	FSC Scenario		
	Recon	Breach	Cordon and Search
How many times did you play this scenario?	0 1 2 3 or more	0 1 2 3 or more	0 1 2 3 or more
If you played the scenario, was it challenging?	Yes...No	Yes...No	Yes...No
If you played the scenario, how many times did you modify your plan the last time you played it?	0 1 2 3 4 5 or more	0 1 2 3 4 5 or more	0 1 2 3 4 5 or more
Did you learn anything about mission execution with FSC that you had not learned otherwise?	Yes...No	Yes...No	Yes...No

If your answer in the last row of the table was "Yes" for any scenario, indicate what was learned by using FSC.

Was the learning unique to FSC more significant for one scenario than for others? Circle: Yes or No . If Yes, indicate how the scenarios differed in this regard.

[Continue on next page]

Part 4. FSC Fidelity

The FSC simulation can be assessed in terms of different types of fidelity:

- **Physical fidelity** – The degree to which the displayed physical environment is realistic. Do individuals look and move like real people? Are buildings realistic? Does the terrain look realistic?
- **Tactical fidelity** – The degree to which Blue and Enemy force elements behave in accordance with doctrine or reasonable expectations.
  - **Blue force** – Does the Blue force react according to doctrine? Does it react in a timely manner?
  - **Enemy force** – Does the Enemy force react as you would expect an enemy to react given the activities of the Blue force?
- **Psychological fidelity** – The degree to which you become involved in your role as Company Commander during mission execution.

In the table below, provide your assessment of FSC in terms of these types of fidelity.

Type of Fidelity	Is this fidelity important in FSC?	How good was this fidelity in FSC?	Identify FSC features that support your assessment
Physical	Yes Somewhat No	Excellent Good Adequate Poor Inadequate	
Tactical – Blue Force	Yes Somewhat No	Excellent Good Adequate Poor Inadequate	
Tactical – Enemy Force	Yes Somewhat No	Excellent Good Adequate Poor Inadequate	
Psychological	Yes Somewhat No	Excellent Good Adequate Poor Inadequate	

Rank order the four types of fidelity in terms of their relative importance. Use "1" to indicate most important and "4" to indicate least important

Physical ____ Tactical – Blue ____ Tactical – Enemy ____ Psychological ____

[Continue on next page]

Part 5. Capability to Perform ICCC Action Items Using FSC

FSC was designed so you could perform the ICCC action items listed below. For each action item, mark an "X" in the appropriate box to indicate **how well FSC let you perform** (i.e., practice) **the item**. Then, circle Yes or No in the last column to indicate if this capability should be kept in future versions of FSC.

ICCC Action Item	Not at all	Not Very Well	Moderately Well	Very Well	Keep in Future Versions
Analyze civil considerations.					Yes No
Analyze the enemy situation.					Yes No
Apply selected defensive considerations to develop a tactical plan.					Yes No
Apply selected steps of the troop leading procedure.					Yes No
Apply the fundamentals of conducting a movement to contact.					Yes No
Conduct an after action review for a light infantry company.					Yes No
Conduct mission analysis.					Yes No
Conduct reconnaissance.					Yes No
Develop a course of action for a light infantry company.					Yes No
Determine own force potential combat power.					Yes No
Integrate fire support into urban operations.					Yes No
Integrate selected fundamentals and specific planning considerations of the offense in an urban environment.					Yes No
Integrate the fundamentals and techniques of the offense into a course of action.					Yes No
Issue a company/team OPORD.					Yes No
Issue a FRAGO.					Yes No
Issue OPORD for infantry company.					Yes No
Perform terrain analysis.					Yes No
Plan breaching operations.					Yes No
Select a course of action.					Yes No
Synchronize a light company team attack in an urban operation.					Yes No
Synchronize the engineer portion of a light infantry company attack.					Yes No
Synchronize the indirect fires portion of a light infantry company attack.					Yes No

[Continue on next page]

Part 5. – Continued

The capability to perform the following action items was ***not*** included in the current version of FSC. Indicate by circling Yes or No which of these items should be included in future versions of FSC. For those items you circle "Yes," rank order the five action items that you believe most need to be included in future versions of FSC. The most important item should be assigned a "1" and the least important item should be assigned a "5".

ICCC Action Item	Put in Future Versions	Rank Five Most Important
Apply emerging threat operations to tactical planning.	Yes No	
Conduct an after action review of a mechanized company/team operation.	Yes No	
Conduct TEWT.	Yes No	
Construct a company METL.	Yes No	
Defend a company/team battle position.	Yes No	
Develop a communications plan.	Yes No	
Issue an air movement and landing plan.	Yes No	
Issue an OPORD for a mechanized infantry company.	Yes No	
Issue engineer portion of the OPORD.	Yes No	
Issue fire support portions of OPORD.	Yes No	
Perform weather analysis	Yes No	
Plan a hasty air assault.	Yes No	
Plan defensive fire support for mechanized infantry company/team.	Yes No	
Plan mobility operations.	Yes No	
Plan offensive fire support for a mechanized infantry company/team.	Yes No	
Plan protective obstacles.	Yes No	
Plan survivability operations.	Yes No	

[Continue on next page]

Part 6. Overall Opinion of FSC

1. Does high quality training using FSC depend on an experienced instructor? Circle: Yes or No .
Can you learn as much using FSC on your own? Circle: Yes or No
Briefly indicate the basis for your answers.

2. Identify (a) what you most liked and (b) what you most disliked about the following components or aspects of FSC. For your most disliked feature of each component or aspect of FSC, what improvements would you recommend?

- User Manual

- Training to use FSC

- Your interface with FSC during the mission **planning** phase

- Your interface with FSC during the mission **execution** phase

[Continue on next page]

3. What did you like **best** about FSC? List up to three features of FSC and indicate what you liked about them.

4. What did you like **least** about FSC? List up to three features of FSC and indicate what you disliked about them.

5. In spite of any possible limitations you may have encountered with FSC, what are the advantages or potential of FSC for improving the decision-making skills of individuals in ICCC?

Write your additional comments and suggestions here and on the backside of the pages.

[Thank you for completing this questionnaire]

Janus Scenario Assessment Checklist

Date: Time: (circle) AM PM

ASSESSMENT RATINGS:

P - Plan accommodated activity.
1 - Failed to recognize the need to change - as result did nothing
2 - Recognized need to change - did not deviate from plan.
3 - Recognized need to change, implemented poor decision - results negative.
4 - Recognized need to change, implemented poor decision - results positive.
5 - Recognized need for change, implemented appropriate response - results positive.
O -Other (No adaptive thought required because previous linking task was performed correctly).

TASK **Each statement begins with, "In my opinion, this leader or this leader's plan..."**	RATING	DOCTRINAL REFERENCE **All tasks are documented in FM 3-0, FM 3-90, FM 7-10, FM 101-5, ARTEP 7-10 MTP, or ICCC advance sheets.**
1. Applied adequate control measures to facilitate C2 and mitigate risk.		ICCC Advance Sheet A2: Includes adequate control measures to facilitate C2 and mitigate risk (phase lines, SBF's, routes, RFL's, NFA's, etc.).
2. Employed proper movement techniques to the objective.		ARTEP 7-10 MTP. Task 7-2-1025. Move Tactically. (1) Based on estimate of the situation, CDR designates the technique to be used (traveling, traveling overwatch, or bounding overwatch). (2) CO moves in the formation directed by the CDR (column, line, wedge, vee, file, or echelon [right or left]). (3) CDR changes formation/movement based on terrain and enemy situation.
3-1. Reacted appropriately to Scout SPOT report (confirm enemy locations) and adjusted plan, as necessary.		ARTEP 7-10 MTP (DRAFT). Task 7-2-1000. CO Attack: (1) CDR addresses actions on chance contact with the enemy. (2) CDR revises plan based on updated intelligence and reconnaissance effort.
3-2. Reacted appropriately to Scout SPOT report (enemy update) and adjusted plan, as necessary.		ARTEP 7-10 MTP (DRAFT). Task 7-2-1000. CO Attack: (1) CDR addresses actions on chance contact with the enemy. (2) CDR revises plan based on updated intelligence and reconnaissance effort.
4. Authorized mortars to support Scouts when they requested assistance.		ICCC Advance Sheet A2: (1) CDR analyzes own force potential combat power to include available resources and assets (including organic and supporting BOS assets) IAW Change 2, FM 7-10. (2) Utilizes all assets available (Javelins, 60mm mortars, ADA, scouts, artillery, rifle platoons and machineguns, XO, 1SG) in a manner that takes maximum advantage of their capabilities.
3-3. Reacted appropriately to Scout SPOT report (renewed enemy movement) and adjusted plan, as necessary.		ARTEP 7-10 MTP (DRAFT). Task 7-2-1000. CO Attack: (1) CDR addresses actions on chance contact with the enemy. (2) CDR revises plan based on updated intelligence and reconnaissance effort.
5. Maintained positive control of unit actions during enemy contact.		ARTEP 7-10 MTP. Task 7-2-1001. Take Action On Contact. CO executes COA selected by CDR per BN CDR's direction. The CO (1) assaults enemy, or (2) bypasses enemy using appropriate formation and movement, or (3) fixes and suppresses, or (4) establishes a defense. ARTEP 7-10 MTP. Task 7-2-1007. Overwatch/Support By Fire. CDR: (1) Selects appropriate position provides observation and FOF, cover & concealment, is key terrain, limited enemy AAs, & weapons are within range). (2) Designates fire procedures & control measures (TRPs, sectors of fire, engagement methods, safety limits, engagement priorities, signals for open/cease/lift or shift fires, targets, tasks specific WPNS. (3) Key weapon systems positioned based on engagement method (MTRs & AT WPNs).
6. Adapted mission as the enemy situation developed.		ARTEP 7-10 MTP (DRAFT). Task 7-2-1000. CO Attack: (1) CO CDR revises plan based on updated intelligence and reconnaissance effort.

ASSESSMENT RATINGS:	P - Plan accommodated activity. 1 - Failed to recognize the need to change - as result did nothing 2 - Recognized need to change - did not deviate from plan. 3 - Recognized need to change, implemented poor decision - results negative. 4 - Recognized need to change, implemented poor decision - results positive. 5 - Recognized need for change, implemented appropriate response - results positive. O -Other (No adaptive thought required because previous linking task was performed correctly).	
7. Conducted attack IAW approved Army doctrine.		ARTEP 7-10 MTP (DRAFT). Task 7-2-1000. CO Attack: (1) Does not stop after moving forward of the assault position. (2) Controls supporting fires to prevent fratricide. (3) Shifts or lifts fires or displaces weapons systems to positions where continuous fire can be maintained. (4) Isolates the objective. (5) Moves onto the objective by conducting fire and movement. (6) Uses indirect fires to isolate portions of the objective area to obscure enemy element and or to screen the movement of the assault element. (7) Destroys enemy, captures enemy, and/or forces their withdrawal from the objective area IAW the commander's intent. (8) Occupies designated defensible positions as necessary. (9) Assaults through the objective to occupy defensible terrain beyond the objective, if the objective is not defensible. (10) Prepares for a counterattack (11) Company continues operations as directed.
3-4. Reacted appropriately to Scout SPOT report (enemy movement update) as a new potential threat and adjusted plan, as necessary.		FM 3-0 (1) Para 7-81: As the operation unfolds and the situation changes, CDRs continuously assess threats and opportunities and decide whether to modify the concept of the operation. (2) Para 7-106: Situational understanding, supported by the common operational picture (COP), allows CDRs to synchronize their forces effectively and make rapid adjustments as the situation changes.
8. Reacted correctly to report of break in contact.		FM 3-0 (1) Para 7-81: As the operation unfolds and the situation changes, CDRs continuously assess threats and opportunities and decide whether to modify the concept of the operation. The CDR should reassess the situation. RATIONALE: The temporary loss of one maneuver squad should not dramatically impact the concept of the operation. The CDR should either elect to continue with the mission or, if rally points were identified during the planning phase, temporarily halt to allow stragglers to catch up, but the overall consideration is to continue the mission.
9. Maintained accurate appraisal of friendly unit status during sustained enemy contact.		FM 3-0 (1) Para 7-81: As the operation unfolds and the situation changes, CDRs continuously assess threats and opportunities and decide whether to modify the concept of the operation. (2) Para 7-106: Situational understanding, supported by the common operational picture (COP), allows CDRs to synchronize their forces effectively and make rapid adjustments as the situation changes.
3-6. Reacted correctly to report of enemy forces located near or on his proposed route of march.		ARTEP 7-10 MTP (DRAFT). Task 7-2-1000. CO Attack: CDR revises plan based on updated intelligence and reconnaissance effort.
10. Emplaced blocking position per OPORD.		Requirement Per OPORD.
11. Reacted correctly to direct/indirect fires from enemy platoon on the objective.		ICCC Advance Sheet A1: Define and explain combat power IAW FM 101-5-1 and include discussion on why it is important to apply combat power at the decisive point. Define and explain combat power IAW FM 3-90, p. 2-3. ICCC Advance Sheet A2: (1) Ensures that combat power is massed at the decisive point to achieve desired results. (2) Include discussion on the criticality of synchronization as it applies to combat power and the decisive point IAW FM 3-0 and FM 101-5-1.
12. Provided chain of command with accurate situation reports (SITREPS conveyed actual situation).		ARTEP 7-10 MTP (DRAFT). Task 7-2-1000. CO Attack: (1) Company commander assesses and reports the situation to higher headquarters.

ASSESSMENT RATINGS:	P - Plan accommodated activity. 1 - Failed to recognize the need to change - as result did nothing 2 - Recognized need to change - did not deviate from plan. 3 - Recognized need to change, implemented poor decision - results negative. 4 - Recognized need to change, implemented poor decision - results positive. 5 - Recognized need for change, implemented appropriate response - results positive. O -Other (No adaptive thought required because previous linking task was performed correctly).	
13. Consolidated/reorganized to secure objective before continuing with mission.		ARTEP 7-10 MTP. Task 7-2-1047. Consolidate and Reorganize. (1) PLTs move to positions assigned by CDR. (2) EN resistance destroyed, captured, or forced to withdraw. (2) Maintain pressure on withdrawing EN with CO direct and in-direct fires.
14. Maintained the momentum of the attack.		ICCC Advance Sheet A0: FM 3-0 p. 4-13, "Seize, retain, and exploit the initiative."
15. Employed proper movement techniques to reinforce the blocking position.		ARTEP 7-10 MTP. Task 7-2-1025. Move Tactically. (1) Based on estimate of the situation, CDR designates the technique to be used (traveling, traveling overwatch, or bounding overwatch). (2) CO moves in the formation directed by the CDR (column, line, wedge, vee, file, or echelon [right or left]). 3. CDR changes formation/movement based on terrain & enemy situation.
3-7. Reacted appropriately to Scout SPOT report (enemy movement update) as a new potential threat and adjusted plan, as necessary.		FM 3-0 (1) Para 7-81: As the operation unfolds and the situation changes, CDRs continuously assess threat and opportunities and decide whether to modify the concept of the operation. (2) Para 7-106: Situational understanding, supported by the common operational picture (COP), allows CDR to synchronize force effectively and make rapid adjustments as the situation changes.
16. Identified that he had priority of fires for artillery and used it to assist completing his mission.		ICCC Advance Sheet A2: (1) CDR analyzes own force potential combat power to include available resources and assets (including organic and supporting BOS assets) IAW Change 2, FM 7-10. (2) Utilizes all assets available (Javelins, 60mm mortars, ADA, scouts, artillery, rifle platoons and machineguns, XO, 1SG) in a manner that takes maximum advantage of their capabilities.
17. Outcome matched the BN CDR's desired end state.		ICCC advance Sheet A1: CDR communicates what the force must do to be successful with respect to the enemy, terrain, and the desired end state IAW Chg 2 to FM 7-10. ICCC Advance Sheet A2: States the desired end state.
18. Accomplished the mission.		If student failed to successfully accomplished mission, failed to conduct adaptive reasoning when required, conducted an example of exceptional adaptive reasoning, or conducted major tactical errors, use the comments block, below.
COMMENTS (Include task number):		

Summary of Doctrinal Errors Committed During the Janus Exercise

At the conclusion of each mission, notes from the Janus Scenario Assessment Checklist and notes taken during the battle, were used to prepare a synopsis of the battle. The synopses focused not only on the flow of the battle, but also on the doctrinal errors committed by each Soldier.

Once the synopses were completed, the observer/controller reviewed them to identify the doctrinal errors that occurred during each mission. A list was prepared that identified common errors made by each Soldier. The list of doctrinal errors for each Soldier was annotated and added to each synopsis. The table below identifies the common doctrinal errors that were considered.

Common Doctrinal Errors
Terrain Analysis Errors
Did Not View the Battlefield from the OPFOR Commander's Perspective
Overestimated Movement Speed
Overall Poor Concept of the Operation
Failed to Isolate the Objective (No blocking position established)
Failed to Adjust Plan to Revised Enemy Threat
Failed to Maintain Mutual Support Among Maneuver Elements
Failed to Provide Timely Supporting Fires
Failed to Sweep Objective
Failed to Adequately Synchronize Battlefield Assets

APPENDIX B

DETAILED RESULTS FROM THE BIOGRAPHIC QUESTIONNAIRE ANDTHE FULL SPECTRUM COMMAND QUESTIONNAIRE

Page

Table B-1

Definition and Descriptive Statistics for Indices of Military Experience Derived From Responses to Items in the Biographical Information Questionnaire

Item #	Index of Military Experience	n	Mean	SD
8	Number of different duty positions reported (less pure training assignments)	53	4.2	1.4
8	Total months of duty positions reported (less pure training assignments)	52	70.0	42.8
8	% Total months in assignments below Company level	52	58.1	24.9
8	% Total months at Company level	52	20.9	17.9
8	% Total months in line positions (at or below Company level)	52	79.0	20.0
8	% Total months in Staff assignments	52	21.0	20.0
8	% Total months in assigned to a TOE unit	42	74.4	34.5
8	% Total months assigned to a TDA unit	42	8.2	14.9
8	% Total months in active component unit	43	82.9	33.4
8	% Total months in reserve component unit	42	17.5	33.7
10	% Participants with prior enlisted experience (Y/N)	52	44.2	~
11	Number of different Combat Training Centers experienced	54	0.9	0.8
12	% Participants with operational experience in OCONUS assignments (Y/N)	53	58.5	~
12	Number of different OCONUS operational experiences (OE)	24	1.4	0.6
12	Number of OEs in which combat operations were experienced	30	0.5	0.7
12	Number of OEs in which stability operations were experienced	31	0.8	0.6
13	Number of 14 named military events experienced at platoon level	54	6.8	3.8
13	Number of 14 named military events experienced at company level	54	5.0	3.4
13	Number of 14 named military events experienced at staff level	54	2.0	2.5

Note: It was often not possible to determine from responses to the questionnaire the experience level of international students or students from the U.S. Marine Corps with respect to assignments in TOE vs. TDA units, active component vs. reserve component assignments, or operations outside the continental U.S.

Table B-2

Descriptive Statistics for Part 1 of the FSC Questionnaire - Involvement Items (n=26)

Item #	Item	Mean	SD	Median	Rating 1	2	3	4	5	6	7
Mean 1-24	(Rating intervals for frequency counts: 2.51-3.5, 3.51-4.50, 4.51-5.50, 5.51-6.5)	4.63	0.64	4.68			2	8	14	2	
1	How much were you able to control events during the planning phase of the mission?	5.5	1.0	5				4	11	6	5
2	How much were you able to control events during the execution phase of the mission?	4.3	1.2	4	1		5	9	6	5	
3	How responsive was the FSC environment to actions that you initiated?	4.5	1.2	5	1	1	1	9	9	5	
4	How natural did you interactions with the FSC environment seem to be?	4.7	1.0	5			4	5	13	3	1
5	How involved were you with events in the FSC environment?	5.0	1.1	5			1	10	7	5	3
6	How natural were the processes that controlled movement through the FSC environment?	4.7	1.3	5		3	1	5	11	5	1
7	How completely were you able to actively survey or search the FSC environment?	4.9	1.2	5			4	7	5	8	2
8	Were you able to anticipate what would happen next in response to the actions that you initiated?	4.5	1.1	5		2	2	8	9	5	
9	How much did your experiences in the FSC environment seem consistent with your real world experiences?	3.8	1.4	4	1	4	5	7	6	3	
10	How compelling was your sense of people and objects moving through space?	4.9	1.1	5		1	2	5	10	7	1
11	How compelling was your sense of moving around inside the FSC environment?	5.0	1.1	5			4	3	11	6	2
12	How well could you examine people and objects from multiple positions in the simulated battlefield environment?	4.8	1.2	5			5	3	10	7	1
13	How well could you move or manipulate objects in the FSC environment?	4.5	1.3	5		3	3	4	11	4	1
14	How involved were you in the experiences provided by the FSC environment?	4.7	1.2	5		2	2	5	11	6	
15	How quickly did you adjust to experiences provided by FSC?	5.3	1.1	5			1	5	10	6	4
16	How proficient do you feel moving in and interacting with the simulated environment at the conclusion of your experiences with FSC?	4.3	1.2	4	1		4	10	6	5	
17	***How much did the quality of the visual display interfere or distract you from performing necessary tasks or required activities?***	4.9	1.4	5			5	7	4	5	5
18	***How much did the input or control devices interfere or distract you from performing necessary tasks or required activities?***	4.2	1.4	4	1	3	1	11	7	1	2
19	How well could you concentrate on performing necessary tasks or required activities rather than on the mechanisms used to perform those tasks or activities?	4.2	1.4	4		3	5	6	9	1	2
20	***To what extent did events occurring in or outside the classroom distract from your experiences in the FSC environment?***	5.6	1.6	6	1		1	4	4	6	10
21	***Overall, how much did you focus on using the display and the control devices rather than on the experiences created by FSC for commanding a company mission?***	3.0	1.1	3	2	7	8	7	2		
22	Were you so involved in commanding the simulated mission that you lost track of time?	4.3	1.7	4 & 5	2	2	5	4	7	3	3
23	Were there moments during your experience with FSC when you felt completely focused on the task of commanding a company mission?	5.0	1.6	5	1	1	1	6	6	6	5
24	How did the total duration of a mission execution affect your sense of involvement in the FSFC experience?	4.7	1.4	5	1	2		8	8	5	2

Reverse Scored: Rating scale value 1=7, 2=6, ..., 6=2, 7=1

Table B-3

Descriptive Statistics for Part 2 of the FSC Questionnaire - Overall Training Value Items (n=26)

Item #	Item	Mean	SD	Median	Rating						
	Reverse scored: *Rating scale value 1=7, 2=6, ..., 6=2, 7=1)*				1	2	3	4	5	6	7
Mean (1-10)	(Categories for frequency counts: 2.51-3.5,3.51-4.50, ..., 5.51-6.5)	4.6	1.0	4.7		1	3	6	10	6	
1	Was using FSC a valuable learning experience?	5.0	1.4	5.0		1	4	3	7	7	4
2	Did FSC provide the opportunity to practice your decision-making skills?	5.2	1.3	6.0	1	1		4	5	15	
3	Did FSC allow you to focus on the critical factors that influenced decision-making during simulated tactical operations?	4.6	1.1	5.0		2	1	7	11	5	
4	Do you think your training with FSC will improve our ability to make rapid decisions during future tactical operations?	4.7	1.4	5.0		3	1	7	7	6	2
5	Do you think your training with FSC will make you **more confident** in your ability to make appropriate decisions during future tactical operations?	4.3	1.5	4.5	1	4	2	6	6	7	
6	How many opportunities did FSC give you to adapt to uncertain conditions during simulated tactical operations?	4.1	1.5	4.0	2	2	3	7	9	2	1
7	Do you think your training with FSC will make you **more confident** in your ability to adapt to uncertain conditions during future tactical operations?	4.2	1.5	4.0	2	2	4	6	6	6	
8	How challenging were the overall experiences provided by FSC?	4.5	1.4	5.0	2		3	6	9	6	
9	***How would you describe the amount of time you spent using FSC?***	4.9	1.5	5.0		2	3	4	9	3	5
10	How desirable is it to use a simulation capability like FSC to experience the possible consequences of executing a tactical plan?	5.3	1.2	5.5			2	5	6	9	4

Table B-4

Descriptive Statistics for Part 3 of the FSC Questionnaire - Training Value of Specific FSC Scenarios Items

Question										
How many times did you play each of the following scenarios?	**n**	**Rating**			**Frequency of Times Reported**					
		Mean	**SD**	**Median**	**0**	**1**	**2**	**>2**		
Reconnaissance scenario	26	1.0	0.8	1.0	6	14	5	1		
Breach scenario	26	1.5	0.9	1.0	2	14	5	5		
Cordon and Search scenario	25	0.5	0.6	0.0	14	10	1	0		
If you played the following scenario, was it challenging?	**n**	**% Yes**								
Reconnaissance scenario	20	75.0								
Breach scenario	24	79.2								
Cordon and Search scenario	11	72.7								
If you played the following scenario, how many times did you modify you plan the last time you played it?	**n**	**Rating**			**Frequency of Times Reported**					
		Mean	**SD**	**Median**	**0**	**1**	**2**	**3**	**4**	**>4**
Reconnaissance scenario	19	1.3	1.4	1.0	6	7	4	0	1	0
Breach scenario	22	1.5	1.5	1.0	7	6	4	3	0	0
Cordon and Search scenario	11	1.1	0.9	1.0	4	2	5	0	0	0
If you played the following scenario, did you learn anything about mission execution with FSC that you had not learned otherwise?	**n**	**% Yes**								
Reconnaissance scenario	20	35.0								
Breach scenario	24	45.8								
Cordon and Search scenario	11	63.6								
Was the learning unique to FSC more significant for one scenario than for the others?	21	38.1								

Table B-5

Descriptive Statistics for Part 4 of the FSC Questionnaire – FSC Fidelity Items

Item

Are the following types of fidelity important in FSC?	n	Frequency of Response		
		No	Somewhat	Yes
Physical fidelity	26	1	8	17
Blue Force fidelity	25	2	3	20
Enemy Force fidelity	25	2	6	17
Psychological fidelity	26	0	8	18

How good were the following types of fidelity in FSC?	n	Rating			Frequency of Rating Response				
		Mean	SD	Median	1-Inadequate	2-Poor	3-Adequate	4-Good	5-Excellent
Physical fidelity	26	3.6	0.7	2	0		13	10	3
Blue Force fidelity	25	3.1	0.8	4	1	3	14	6	1
Enemy Force fidelity	25	3.5	1.0	2	0	5	5	12	3
Psychological fidelity	25	3.4	0.9	3	1	2	11	9	2

Provide the rank order the following types of fidelity.	n	Rank			Frequency of Rank Response			
		Mean	SD	Median	1	2	3	4
Physical fidelity	26	2.9	1.2	3	5	4	5	12
Blue Force fidelity	25	1.6	0.8	1	15	6	4	0
Enemy Force fidelity	25	2.7	0.7	3	0	12	9	4
Psychological fidelity	25	2.8	1.2	3	6	3	7	9

Table B-6

Descriptive Statistics for Part 5a of the FSC Questionnaire – Capability to Perform ICCC Action Items Using FSC

ITEM					Frequency of Rating				Keep in Future Versions of FSC?	
For each ICCC action item listed below, indicate how well FSC let you perform (i.e., practice) the item. Then, indicate if this FSC capability should be kept in future versions of FSC.	n	Mean	SD	Median	1 Not At All	2 Not Very Well	3 Moderately Well	4 Very Well	n	% Yes
Analyze civil considerations.	23	2.0	0.9	2.0	8	7	8	0	21	100.0
Analyze the enemy situation.	25	3.2	0.7	3.0	1	2	14	8	26	100.0
Apply selected defensive considerations to develop a tactical plan.	23	2.4	1.0	3.0	6	5	9	3	24	91.7
Apply selected steps of the troop leading procedure.	25	3.0	0.5	3.0	0	3	19	3	26	100.0
Apply the fundamentals of conducting a movement to contact.	24	2.7	0.6	3.0	0	9	13	2	24	95.8
Conduct an AAR for a light infantry company.	24	3.0	1.0	4.0	3	3	9	9	25	100.0
Conduct mission analysis.	25	3.0	0.8	3.0	0	7	10	8	26	96.2
Conduct reconnaissance.	25	2.8	0.8	3.0	1	8	11	5	26	96.2
Develop a course of action for a light infantry company.	26	3.5	0.6	4.0	0	2	10	14	26	100.0
Determine own force potential combat power.	26	3.3	0.7	3.5	0	3	12	11	26	100.0
Integrate fire support into urban operations.	25	2.8	0.8	3.0	1	8	12	4	25	100.0
Integrate selected fundamentals and specific planning considerations of [urban] offense.	25	2.9	0.8	3.0	1	5	14	5	26	100.0
Integrate the fundamentals and techniques of the offense into a course of action.	25	3.0	0.6	3.0	0	5	16	4	26	96.2
Issue a company/team OPORD.	25	2.2	0.7	2.0	4	14	6	1	26	92.3
Issue a FRAGO.	25	3.2	0.8	3.0	0	6	9	10	26	100.0
Issue OPORD for infantry company.	24	2.2	0.8	2.0	5	10	9	0	26	92.3
Perform terrain analysis.	25	2.6	0.6	3.0	1	8	15	1	26	100.0
Plan breaching operations.	25	3.0	0.7	3.0	1	3	15	6	26	100.0
Select a course of action.	24	3.3	0.6	3.0	0	2	14	8	26	100.0
Synchronize a light company team attack in an urban operation.	25	2.9	0.9	3.0	1	8	9	7	26	96.2
Synchronize the engineer portion of a light infantry company attack.	25	2.6	1.0	3.0	4	5	12	4	26	100.0
Synchronize the indirect fires portion of a light infantry company attack.	25	2.9	0.9	3.0	2	6	10	7	26	96.2

Table B-7

Descriptive Statistics for Part 5b of the FSC Questionnaire –New Capabilities to Add to Future Versions of FSC

Item	Include?		Rank of Five Most Important New Capabilities								
Indicate if the capability to perform the following ICCC action items should be included in future versions of FSC. Then, rank order the five that most need to be included in future versions of FSC.	n	% Yes	n	Mean	SD	Median	Frequency of Rank				
							1	2	3	4	5
Apply emerging threat operations to tactical planning.	25	88.0	12	2.0	1.5	1.0	7	2	0	2	1
Conduct an after action review of a mechanized company/team operation.	25	80.0	2	3.0	1.4	3.0	0	1	0	1	0
Conduct TEWT.	25	16.0	1	5.0	.	5.0	0	0	0	0	1
Construct a company METL.	25	32.0	2	2.0	0.0	2.0	0	2	0	0	0
Defend a company/team battle position.	26	88.5	12	2.9	1.4	3.0	2	3	4	0	3
Develop a communications plan.	26	42.3	3	5.0	0.0	5.0	0	0	0	0	3
Issue an air movement and landing plan.	26	61.5	3	2.3	1.5	2.0	1	1	0	1	0
Issue an OPORD for a mechanized infantry company.	26	73.1	8	2.9	1.6	2.5	2	2	1	1	2
Issue engineer portion of the OPORD.	26	61.5	3	2.7	1.2	2.0	0	2	0	1	0
Issue fire support portions of the OPORD.	26	73.1	7	2.7	1.8	3.0	3	0	2	0	2
Perform weather analysis.	25	48.0	3	3.3	1.2	4.0	0	1	0	2	0
Plan a hasty air assault.	26	80.8	10	2.8	1.1	3.0	1	3	4	1	1
Plan defensive fire support for mechanized infantry company/team.	26	80.8	6	3.5	1.0	3.5	0	1	2	2	1
Plan mobility operations.	26	61.5	4	4.0	0.8	4.0	0	0	1	2	1
Plan offensive fire support for a mechanized infantry company/team.	26	88.5	9	3.2	1.4	4.0	2	0	2	4	1
Plan protective obstacles.	26	80.8	8	3.9	1.1	4.0	0	1	2	2	3
Plan survivability operations.	26	73.1	1	3.0	.	3.0	0	0	1	0	0